# SCIENCE

12 October 1956

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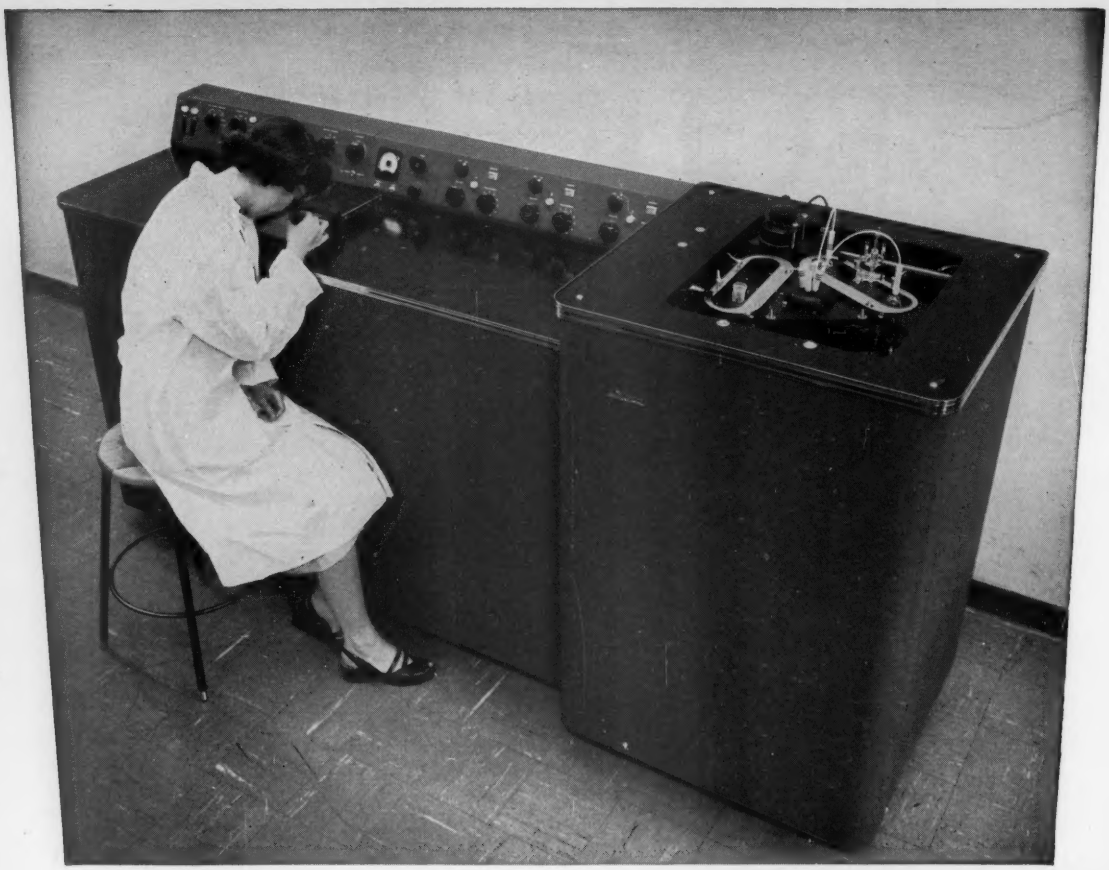
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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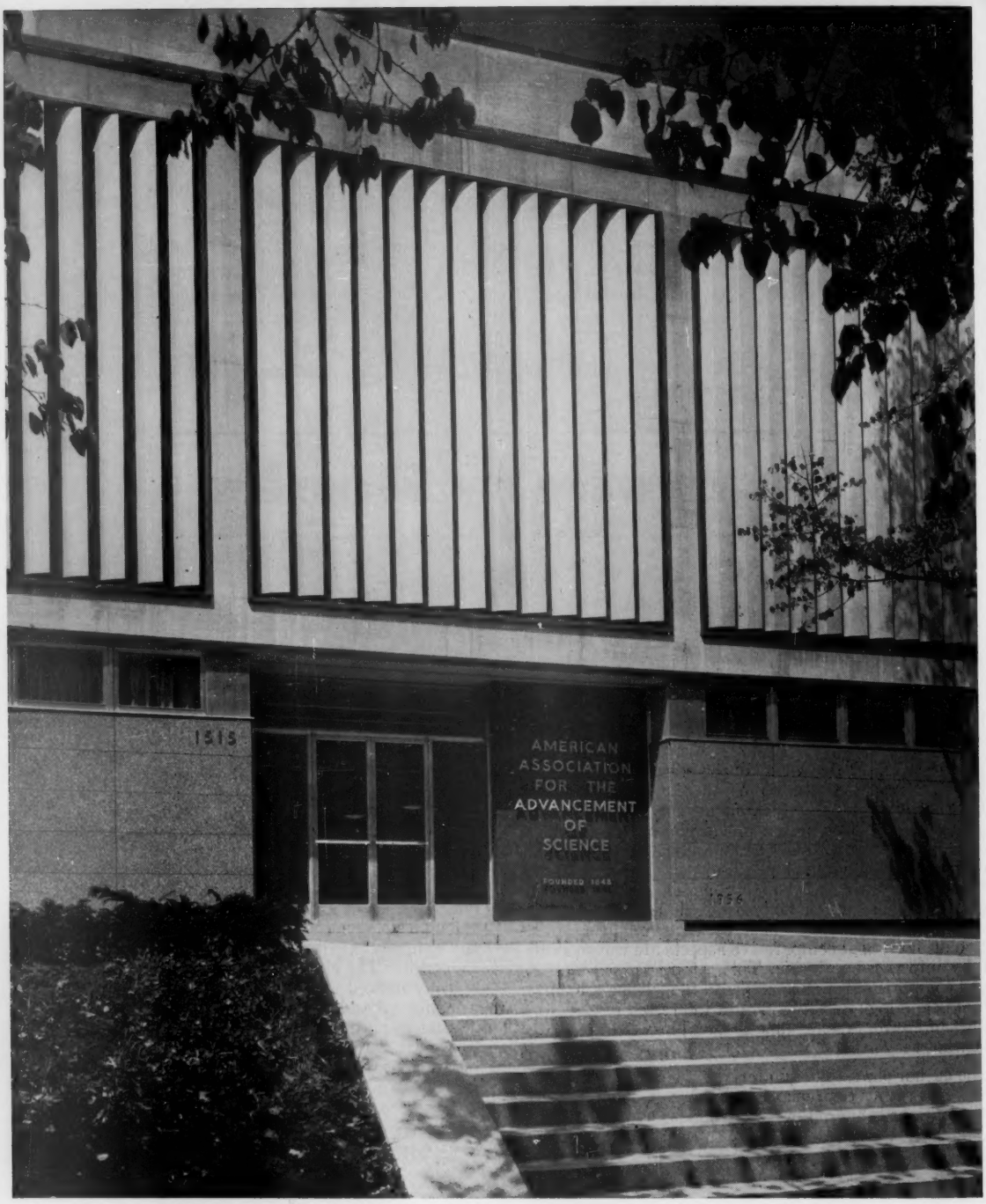


Main entrance, facing Massachusetts Avenue, of the new headquarters building of the American Association for the Advancement of Science. To celebrate the completion of the building a special scientific program on the uses and effects of atomic radiation was held today at the Carnegie Institution of Washington, followed by a dedication ceremony and open house at the new AAAS building. Speakers at the program and the dedication were Caryl P. Haskins, Carnegie Institution of Washington; Shields Warren, New England Deaconess Hospital; L. C. Dunn, Columbia University; Lawrence R. Hafstad, General Motors Corporation; Detlev W. Bronk, Rockefeller Institute; Willard F. Libby, U.S. Atomic Energy Commission; Laurence H. Snyder, University of Oklahoma; and Paul B. Sears, Yale University. [Photo by Davis Studio, Washington, D.C.]

12 October 1956, Volume 124, Number 3224

# SCIENCE



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## Cornerstone

During the course of planning the AAAS building, the architect asked if we wanted a cornerstone. Practice varied, he told us; we could have an elaborate one with an enclosed copper vault in which we might bury selected mementos of science or the Association; we could have one without enclosures but with any inscription we chose; or we could have none at all. The one thing he warned us not to do was to forget to carry to completion whatever plans we agreed upon—a lapse that left another Washington building with a cornerstone that bore only the inscription *Cornerstone*.

We decided not to have any, chiefly because the limited space usually results in paying honor to the few persons who were prominently involved during the limited segment of time when the building was being constructed, while neglecting the many others whose earlier work was of at least equal importance. With more words available here than could be inscribed on two or three square feet of granite, let this editorial recognize the many builders of the AAAS building.

When it became apparent a dozen or so years ago that the Association could no longer continue as a guest of the Smithsonian Institution, F. R. Moulton, who was then Administrative Secretary, and the officers began to look for a suitable site on which the Association could eventually erect its own building. The site we now occupy is the one they selected. Dr. Moulton dreamed of a large building that would serve as a center for many scientific activities and organizations. His dream impressed many as an excellent and a feasible idea, but the cost, and the difficulties of securing permission to erect such a building in an area not zoned for office buildings, persuaded the Association's officers to adopt a less ambitious plan.

The definite decision to build was made during Howard Meyerhoff's term as Administrative Secretary, and most of the necessary money was accumulated during his years of careful management of Association affairs.

Plans became final during the years that E. U. Condon and Warren Weaver served as chairmen of the Association's Board of Directors, and were drawn up under the guidance of a Building Committee that consisted of John R. Dunning, Wallace R. Brode, Detlev W. Bronk, Paul E. Klopsteg, Laurence H. Snyder, and Warren Weaver.

The Association was fortunate in obtaining the services of the architectural firm of Faulkner, Kingsbury and Stenhouse, a choice originally made by F. R. Moulton; the general contractor, William P. Lipscomb Co.; Knoll Associates, who helped plan interiors and supplied the new furniture we needed; and A. Gude Sons Co., who landscaped the grounds. F. P. H. Siddons, chairman of the Association's finance committee, has for many years been a much valued financial adviser. The legal advice of Arthur B. Hanson has helped us repeatedly.

The Association is grateful to its members and friends whose gifts—as small as a dollar and as large as $10,000—have now reached a total of $157,831. That amount plus savings from past years sufficed for all but $175,000 of the total cost. The American Security and Trust Company provided the remainder through a mortgage.

The officers and staff are proud of a building that is new, handsome, and efficient. If the building had a cornerstone, we would want it to bear the names of all the contributors who made the building possible.—D. W.

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# The Architect Reviews His Files

Waldron Faulkner

We have all had the experience, perhaps when lying in bed at night, of trying to reconstruct a train of thought from its conclusion back to its source. This process is similar to what passes through the mind of an architect as he looks over the files on a completed building. In doing so he relives the chain of experiences that resulted in the finished product, with all its hopes and fears, its pleasures and discouragements, its successes and failures.

On examining our files, I find that the first conferences on the new building for the American Association for the Advancement of Science took place in 1945 at the Smithsonian Institution with F. R. Moulton, then administrative secretary. The Association was about to move to new temporary quarters but was planning some day to build a permanent home of its own.

Some time later we developed preliminary drawings for a building on the new site. These show a tall, windowless building to be artificially lighted, heated, and cooled.

A few years afterward, while Howard A. Meyerhoff was administrative secretary, we developed a new scheme for the proposed headquarters building. It was now to have large window areas, but the daylight was to be controlled so as to avoid glare in the offices. On how this was to be accomplished we were not clear at the time.

Another scheme for this building was prepared still later by another group of architects. But this could not be built because the District of Columbia Board of Zoning Adjustment did not give permission for the erection of the proposed building.

In 1954 we were called in by Dael Wolfle, the new administrative secretary, to prepare a new set of plans which would, if possible, meet the requirements of the Board of Zoning Adjustment. The problem was to erect the headquarters building on the site owned by the Association in an area where commercial office buildings were prohibited; no easy assignment!

## Outside Movable Sunshades

The previous problem of daylight control also remained to be solved. By this time we had discovered that vertical louvers, or movable sunshades, made of aluminum had been used successfully in the Far West to control the daylight in buildings, and we decided to look into these as a possibility.

These sunshades are set vertically in rows outside the windows in order to shade them during the day in such a way as to reduce the glare inside the building. They turn during the day by means of an electric motor controlled by an electric clock mechanism and take certain predetermined positions at definite times, depending on the hour of the day and the time of year.

On the east side of the building the sunshades are closed, or partly closed, early in the morning and open gradually during the morning. Their starting position depends on the time of year. On the west side of the building the operation in the afternoon is exactly the reverse of this. The sunshades on the south side of the building operate entirely differently, because the sun covers a wide angle during the day. For this reason the sunshades are open in the early morning and close gradually until noon. At this time they rotate quickly through an angle of 180 degrees and open gradually in the opposite direction in the afternoon. The starting positions and speeds of operation for this installation were determined by A. Olgyay and V. Olgyay of Princeton University.

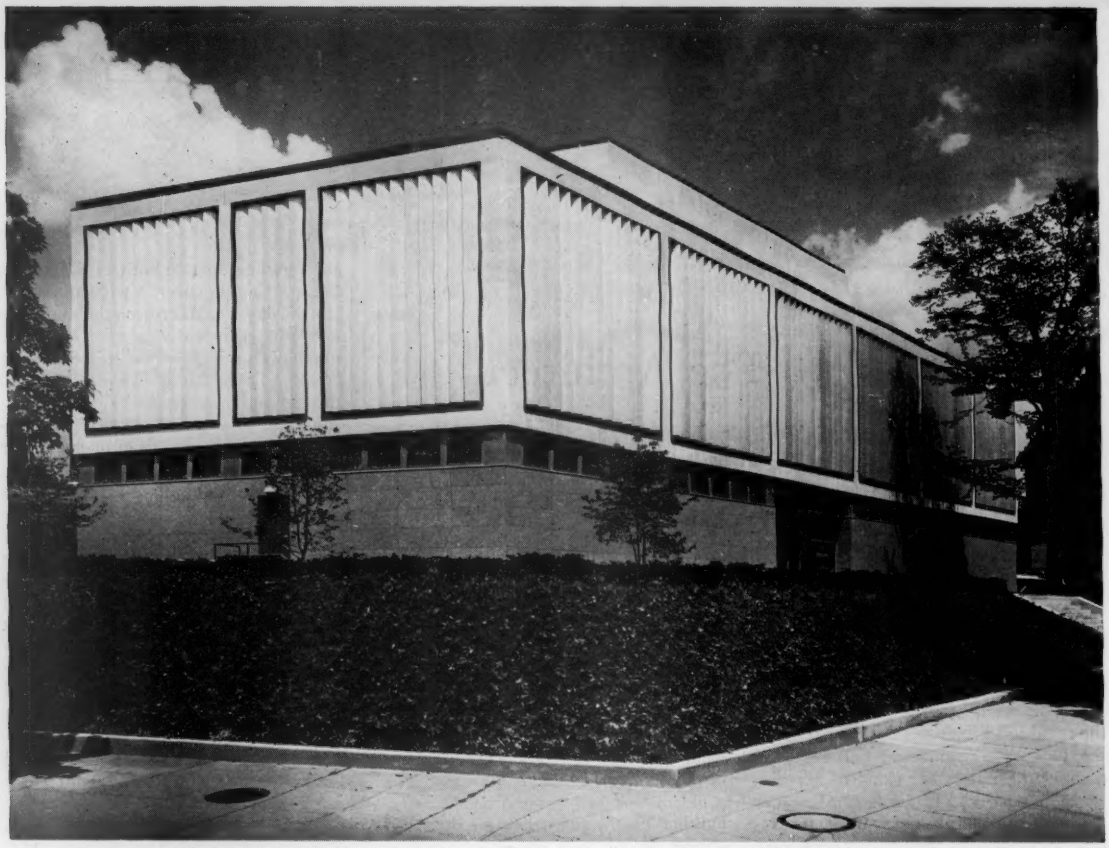
In addition to controlling the admission of sunlight, the shades also reduce the heat absorption through the windows by keeping the glass shaded throughout the day. This brings about economies in the operation of the air-conditioning system. It also means that the capacity and, therefore, the initial cost of the air-conditioning equipment can be considerably reduced.

The sunshades do away with the need for blinds or curtains. They provide a certain amount of privacy during the day and can be closed completely at night, if so desired. In addition to these practical advantages, the shades give a decidedly novel appearance to the building on which they are used.

Before making a decision on the use of the sunshades, our engineers made calculations of their effectiveness as compared with venetian blinds. We were also interested to see what further economies might result from the use of double glazing or of heat-resisting glass in the windows. The results of these calculations indicated that the most advantageous combination would be the sunshades used in conjunction with the double glazing at the windows. This took into account both the first cost and the operation of the air-conditioning system (see Table 1). It was therefore decided to use the sunshades on all but the north side of the building, where there would be no direct sunlight. They were omitted from the first floor because it was felt that they might be too easily damaged so near the ground. A band of small clerestory windows was used at this level in order to insure privacy for those working there.

We also considered one other feature in order to reduce heat loss. This was the substitution of white gravel, instead of the usual wearing surface of black gravel, on the roof.

Mr. Faulkner is head of the architectural firm of Faulkner, Kingsbury & Stenhouse of Washington, D.C.



A view of the south (Massachusetts Avenue) and west (Scott Circle) sides of the new AAAS headquarters building. [Photo by Davis Studio, Washington, D.C.]

Table 1. Comparative costs of heating and air-conditioning.

| Item | Plan A ¼-in. plate glass | | Plan B Double glazing | | Plan C ¼-in. Solex | |
|---|---|---|---|---|---|---|
| | With venetian blinds | With outside louvers | With venetian blinds | With outside louvers | With venetian blinds | With outside louvers |
| *Installation cost* | | | | | | |
| Refrigeration equipment | $ 61,000 | $30,500 | $ 53,900 | $ 30,800 | $53,900 | $ 38,500 |
| Boilers | 10,000 | 10,000 | 9,900 | 9,900 | 10,000 | 10,000 |
| Radiation | 12,500 | 12,500 | 10,200 | 10,200 | 12,500 | 12,500 |
| Glass | 12,000 | 12,000 | 32,000 | 32,000 | 16,000 | 16,000 |
| Louvers | | 25,000 | | 25,000 | | 25,000 |
| Venetian blinds | 5,000 | | 5,000 | | 5,000 | |
| Total installed cost | $100,500 | $98,000 | $111,000 | $107,900 | $97,400 | $102,000 |
| *Annual maintenance cost* | | | | | | |
| Fuel (gas) | 2,940 | 2,940 | 2,360 | 2,360 | 2,940 | 2,940 |
| Maintenance (filters, servicing, electric power, etc.) | 1,540 | 975 | 1,360 | 785 | 1,360 | 975 |
| Total operating cost | $ 4,480 | $ 3,915 | $ 3,720 | $ 3,145 | $ 4,300 | $ 3,915 |
| Depreciation (10 yr) | 10,050 | 9,800 | 11,100 | 10,790 | 9,740 | 10,200 |
| Operating costs per year | 4,480 | 3,915 | 3,720 | 3,145 | 4,300 | 3,915 |
| Total annual cost | $ 14,530 | $13,715 | $ 14,820 | $ 13,935 | $14,040 | $ 14,115 |

## Internal Design

Having reached these conclusions, it was now possible to begin the design of the proposed building. The site is centrally located in a highly desirable neighborhood. The task was to design a building that would meet the needs and desires of the Association and would also be acceptable to the Board of Zoning Adjustment, in addition to satisfying the architects' own artistic conscience. This meant a building large enough to house the activities of the Association for the foreseeable future and, at the same time, not so large as to fall into the category of a commercial office building. It also required a dignified appearance worthy of the organization that it was to house.

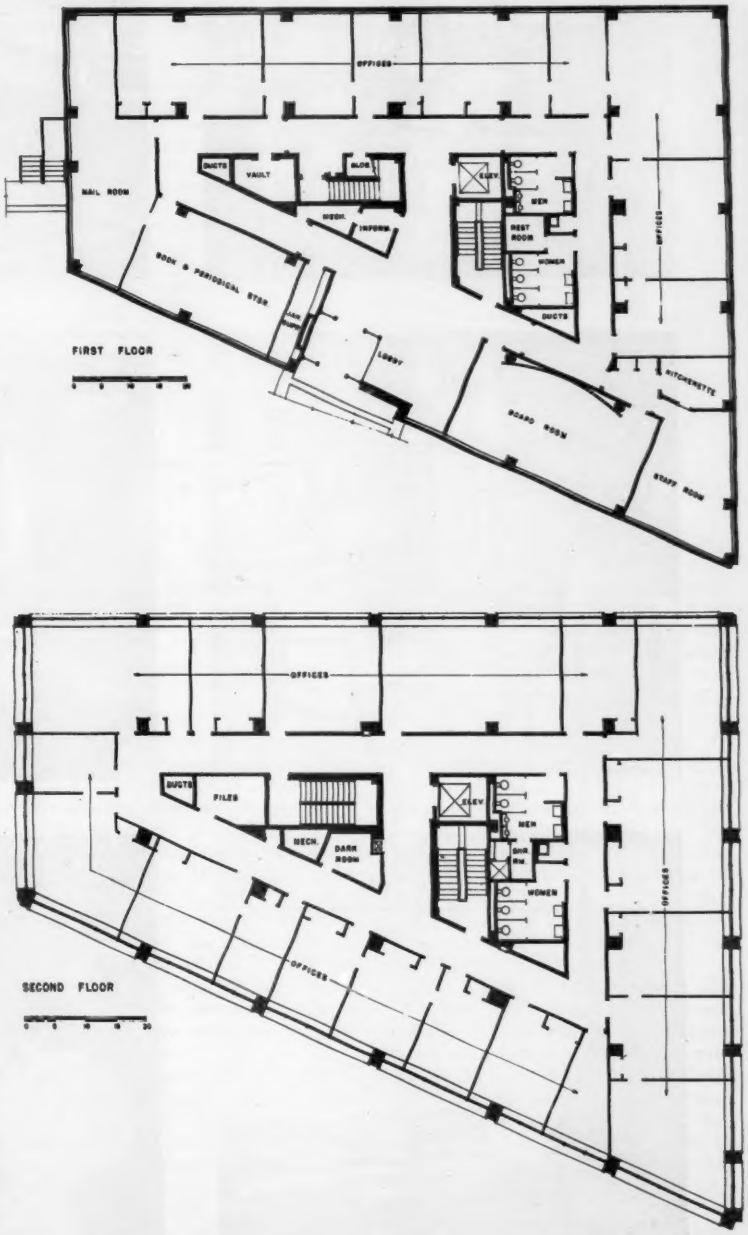
The site on Massachusetts Avenue, Northwest, is bounded by four city streets and forms a trapezoid. It was somewhat restricted in area and was at the time occupied by old buildings, one of which served as the temporary headquarters for the Association. In order to provide the necessary floor area, all the old buildings had to be razed and as much of the site had to be used as the law would allow. This included most of the area between the building restriction lines, and this dictated both the shape and the size of the floor plan. The existing buildings stood on a low plateau about 6 feet above the sidewalk level. It was decided to maintain this grade, thus making it possible to house a parking garage in the basement without having to ramp down as far below the street as would otherwise be necessary. This controlled the level of the first floor of the proposed building. At the same time it gave an economical solution to the parking problem and produced a monumental base for the building. The heating plant and air-conditioning equipment were located in the penthouse on the roof in order to provide more parking space in the basement.

The program indicated that the immediate requirements for office space for the Association could be contained on two floors. In order to meet the requirements of the Board of Zoning Adjustment, it was decided to limit the area for future expansion to one additional floor. At the same time it was also thought wise to design the structural frame of the building so that two more floors could be added later, provided that permission for this could be obtained at some future date.

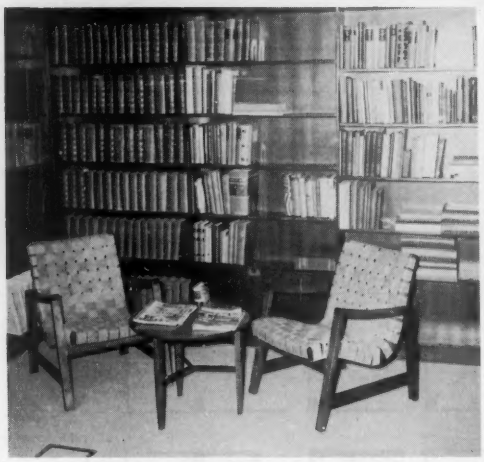
The next step consisted of planning a building around the specific requirements of the owner. If we were to include daylight control, we also had to be sure to arrange for sufficient daylight where needed. The window areas had to be large and were designed in continuous bands so as to insure flexibility of interior arrangement.

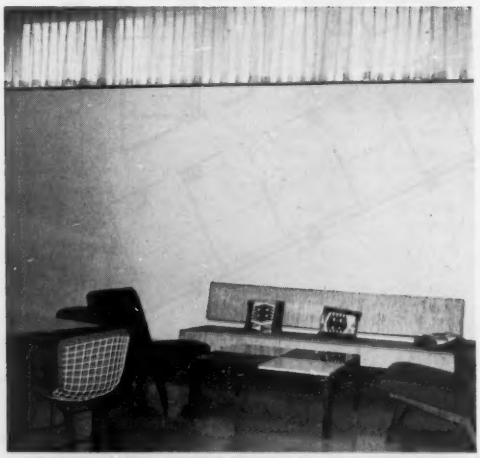
One of the requirements was to make possible the removal of interior partitions in the event that offices had to be moved or enlarged. This led to making the windows about 4 feet wide with mullions between, to which partitions could be attached where desired.

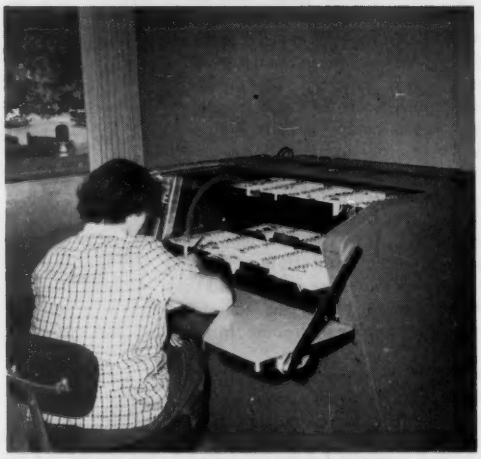
It was agreed that the windows should not be generally operable because the entire building, except the garage, was




The business offices of the Association occupy the east and north sides of the first floor of the new building. The administrative offices and the editorial offices are housed on the second floor. The third floor, on which the arrangement of rooms is similar to that on the second floor, has been rented to several other scientific organizations: American Society of Photogrammetry, American Chemical Society for some of its offices, and the National Academy of Sciences on behalf of the American Geophysical Union and the American Geological Institute.







Some views of the new AAAS building: (top left) one of the editorial offices on the east side of the building; (top right) the board of directors' room; (center left) a corner of the library; (center right) one of the administrative offices on the north side of the building; (bottom left) the staff room; (bottom right) one of the new pieces of equipment in the business office for keeping membership records. [Photos by Hilary Deason, Washington, D.C.]

to be air-conditioned. However, some means had to be found to wash the windows when necessary. This could not be done from the outside, if sunshades were to be used. This meant that the windows had to be hinged to open in and locked so that they could not be opened except for washing.

So as not to interfere with the in-opening windows the partitions at the mullions had to be kept thin. It was therefore decided to use solid plaster nonbearing partitions, 2 inches thick, for this purpose. These could be easily taken down and rebuilt if they had to be moved in the future.

In order to balance the loss of heat in winter from the large glass areas, small radiators were provided at the window sill in each bay. The air-conditioning system was also designed so that the registers would not have to be moved, if partitions should be relocated.

Another feature that makes for internal flexibility is the underfloor electric duct system. These ducts carry electric and telephone wiring under the floors of the offices in two continuous bands around the building. At short intervals along these ducts, both electric and telephone outlets can be installed at any time. If an office is to be moved or if equipment is to be rearranged, new connections can be made where desired.

The same principle was carried out in regard to the electric-lighting system. This also consists of two continuous troughs of fluorescent lights recessed in the ceilings of the offices. These allow for intervals where the partitions intersect the light troughs. However, if the partitions are moved, the lights can be relocated in the continuous trough with a minimum of difficulty.

Another feature makes flexibility of arrangement possible. The interior finishes of all the offices are similar so that if they should be rearranged in the future, no general redecoration would be necessary.

One more problem arose which had a bearing on the question of internal flexibility. This had to do with the structural frame—whether it should be of steel or reinforced concrete. In Washington reinforced concrete is usually less expensive than structural steel.

In a building where the utmost flexibility is desired, a cellular steel floor allows this in the arrangement of telephone and electric circuits. This type of floor requires a steel structural frame, which would also give more headroom for running duct work. However, comparative estimates indicated that the concrete frame would be much more economical (see Table 2), and the steel frame and floor were therefore discarded in favor of concrete.

Table 2. Cost data analysis.

*Name of building*: American Association for the Advancement of Science
*Location*: 1515 Massachusetts Ave., NW, Washington, D.C.
*Type*: Headquarters building
*Date building was started*: July 1955
*Date building was completed*: June 1956
*Total volume*: 407,000 ft$^3$
*Floor area*: 34,600 ft$^2$
*Ceiling heights*: Garage 8 ft 7 in.; 1st floor 11 ft 2 in.; 2nd and 3rd floors, 8 ft 8 in.
*Specifications*:
Reinforced concrete structure
Limestone facing on upper stories
Granite facing at first floor
Aluminum sash, surrounds, and vertical weather controls
Concrete block partitions, except 2-in. plaster partitions between offices
Rubber tile floor and base
Mineral acoustic hung ceilings
*Architect*: Faulkner, Kingsbury & Stenhouse
*Engineer*: James M. Gongwer (structural)
Voss Engineering & Construction, Inc. (mechanical)
*General contractor*: Wm. P. Lipscomb Company, Inc.

| Item | Cost | Percentage of total cost | Cost/ft$^2$ | Cost/ft$^3$ |
|---|---|---|---|---|
| Structure | $543,800 | 77.6 | $15.71 | $1.34 |
| Plumbing | 20,000 | 2.9 | 0.59 | 0.05 |
| Heating, ventilating, air-conditioning | 78,000 | 11.1 | 2.25 | 0.19 |
| Electrical | 59,000 | 8.4 | 1.70 | 0.14 |
| Total cost of building | $700,800 | 100 | $20.25 | $1.72 |

## Final Arrangements

The next step was to clothe this skeleton with an appropriate skin; to give it a dignified architectural expression. The chief esthetic problem was in the use of the sunshades. Although they tended to give the exterior of the building an unusual character, they also precluded any kind of traditional architectural treatment. Although we liked the first studies of the elevations showing the sunshades, we did not know how the Association would react to so radical a departure from accepted precedent. Nor did we know how it would pass muster with the official bodies who would have to approve of the scheme.

In order to satisfy ourselves before showing the drawings to others, we decided to develop a series of elevations, starting with the first scheme and arranging them in graduated steps to a more traditional and less exciting treatment. To our great delight, when this series was shown to the Association, the first sketches were accepted without modification, and the Commission of Fine Arts passed this scheme as it stood.

We were now ready to submit this material to the Board of Zoning Adjustment. We were hopeful that the size and form of the proposed building would meet with their approval. But we were again somewhat fearful of how they might feel about the appearance of the proposed building.

In advance of the public hearing before the Board of Zoning Adjustment, we prepared a scale model showing how the building would look, both with and without the sunshades. We appeared at the hearing under the able guidance of the Association's attorney, Arthur Hanson. The board considered the various problems involved and approved the plans unanimously.

The building was completed in May 1956 and has been in use for several months. It is still too soon to determine whether all the assumptions made in connection with the design of the building or of the equipment are valid. Before long it is planned to run tests on the sunshades to see how closely the theory on which they were built will coincide with actual results on the site. This will bring us to the end of our files on the new building, but the period now past is but a prolog to a new era for the Association.

# University of Michigan Radiocarbon Dates I

H. R. Crane

The radiocarbon dating laboratory of the University of Michigan has been in operation since 1950 (*1*). A curatorial committee has carried the responsibility for negotiating for specimens, for determining the relative priorities of dating specimens, and for cataloging and reporting information concerning specimens. The committee is composed of H. H. Bartlett, department of botany; S. A. Cain, chairman of the department of conservation, School of Natural Resources; C. W. Hibbard, curator of vertebrate paleontology, Museum of Paleontology; V. H. Jones, curator of ethnology, Museum of Anthropology; J. H. Zumberge, department of geology; and J. B. Griffin, director and curator of archeology, Museum of Anthropology, and chairman of the committee (*2*).

In the years 1950–52, the technical method used for carbon-14 determination was very similar to that developed by W. F. Libby and his coworkers (*3*). Some additional features, principally an automatic sample-changing mechanism, were incorporated, as described in earlier articles (*4*). This apparatus operated successfully, but because of the fact that it employed an open carbon-black sample, it was subject to contamination by radioactive fallout from atomic bomb tests. Operation had to be suspended during periods when fallout was present. The interference caused by the atmospheric contamination increased steadily, and in late 1952 the decision was made to suspend operation and to turn to the development of a method that would use a gas sample. Work was begun on a system employing a carbon dioxide-carbon disulfide Geiger counter, and successful operation was resumed with the new method early in 1953. After a period of shakedown and improvement, the steady production of radiocarbon dates with the new method began in early 1954.

Table 1 is the first installment of the list of results obtained from the beginning of operation of the Michigan laboratory in 1950 to the present. Ages obtained with the carbon-black method are marked by an asterisk. In all cases, the type of material of the raw sample is indicated.

Standard deviation figures attached to the ages are in all cases larger than the purely statistical error, which is derived from the number of counts. The figure is chosen in each case so as to be a composite of both the statistical error and our best estimates of the other factors that influence the precision, such as the general consistency of the calibration runs, consistency within the individual run, and so forth. Errors inherent in the samples themselves, such as those caused by the presence of intrusive material, are of course outside our control and are not allowed for in the stated limits of precision. Such possible causes of error should not be forgotten, however, in the interpretation of the results. In cases in which there was any visible reason for suspecting an alteration of the sample material, the fact is noted in the description of the sample.

## Kinds of Errors

Some remarks of a general nature are in order concerning the kinds of errors that may arise in four particular types of measurements: (i) those in which the sample is derived from shell; (ii) those in which the sample is derived from bone, tusk, or antler; (iii) those in which the raw material contains roots; and (iv) those in which the sample is measured in the form of carbon black.

Shell samples have, in our experience and in the experience of others, often yielded ages that are much too large. The effect has been noticed particularly with regard to samples collected in inland waters, bays, and estuaries. The obvious inference that can be drawn from this is that in certain kinds of environment the shell does not get built entirely of carbon that is in carbon-14 equilibrium with the atmosphere. The conditions under which shells will grow with a true "contemporary" carbon-14 content are not sufficiently well understood so that any assurance, one way or the other, can be given a priori concerning a given collected sample. All that we can do at this point is to urge caution in the acceptance of shell dates that are not supported by results on other kinds of material, and to say that where there is an error, it will be expected to be in the direction of making the specimen appear older than it actually is. We include our shell dates in the following list, but do so only with the qualifications given.

The technique that employs a carbon-black sample is open to the possibility of contamination by airborne radioactive debris. When such contamination occurs, it increases the count given by the sample, and thus makes the sample appear to be younger than it actually is. Why is the error predominantly in one direction, that of too small an age? The procedure in measuring a carbon-black sample is to alternate the unknown sample, in the counter, with a standard sample, which is normally one of zero age (from contemporary wood) or of "infinite" age (from petroleum or coal). Contamination of the standard will cause an increase in the apparent age of the unknown, while contamination of the unknown will cause a decrease in its apparent age. The important difference is, however, that if the standard becomes contaminated, the investigator becomes aware of it on the basis of his past data on standard samples, while if the unknown sample becomes contaminated he will not be aware of it. Thus, when contamination affects either the standard or both the unknown and the standard, there is no danger of error because the increased count of the standard warns the experimenter and causes him to reject the whole measurement.

The time when an error may go undetected is when the unknown carries contamination and the standard does not. On the basis of a single run, the experimenter has no way of detecting such an error. The likelihood of such a situation is greatest if the unknown and the standard are prepared at different times, as, unfortunately, must be the case in small laboratories where samples must be processed one at a time. It is therefore of great value to make two measurements, if not at different laboratories, then at least at different times and on carbon prepared from the raw sample at different times. We, and other users of the carbon-black method, have been on constant guard against contamination effects, and we do not believe that the results have been in error in many cases. Nevertheless, we have thought it worthwhile to explain in some detail what the

The author is professor of physics at the University of Michigan and a member of the staff of the Harrison M. Randall Laboratory of Physics.

character of the error is likely to be when it does occur, and to say that its direction is such that it makes the specimen appear to be younger than it really is. When a number of carbon-black measurements on the same sample show a considerable spread, we would, on the basis of the foregoing reasoning, be inclined to adopt a value near the top end of the spread, rather than the average.

Bone, antler, and tooth material bring their own possibilities for error. These materials are porous and may accumulate calcium carbonate from percolating water. Therefore, there are risks in using carbon from the inorganic compounds in these materials for dating. We have, in all cases except where expressly stated, discarded the acid-soluble component of these materials and have obtained our carbon samples from the organic residue. This procedure was discussed in an earlier article from this laboratory (*5*). A very similar procedure has also been described by May (*6*).

In many of the charcoal and peat samples we have processed, we have found the remains of small roots that have intruded, supposedly, from plants or trees growing above the deposit. Such roots have been removed as far as possible with tweezers. However, we have no defense against roots which have intruded and which have become pulverized or otherwise unrecognizable. We can only point out, again as a precaution, that this is a source of error which is at present beyond the control of the measuring technique. When root remains are present, they will, of course, make the sample appear to be younger than it really is.

Table 1. Radiocarbon dates. Ages obtained by the carbon-black method are marked by an asterisk. The other ages were obtained by the gas-sample technique.

| Description | Sample No. | Age (yr) |
|---|---|---|
| I. *Lower Mississippi Valley and southeastern United States* | | |
| *Spiro mound, Okla.* Section of solid, well-preserved juniper log from the central tomb of the main Spiro mound. Should be classic Spiro and should equate with sample M-54. Submitted by Robert E. Bell, University of Oklahoma. | M-14 | 2400 ± 400*<br>1800 ± 400*<br>2700 ± 400*<br>2500 ± 400*<br>2030 ± 500*<br>Average<br>2286 ± 200 |
| *Emerald mound (Selzertown), Miss.* Animal bone from stage E, located in deep drift of village detritus at the south base of the primary platform. Presumably laid down during the early occupational stage of the site, prior to the final stage of the erection of secondary mounds. Emerald mound is located 9 mi northeast of Natchez. Submitted by John L. Cotter, National Park Service. | M-27 | 470 ± 250 |
| *Gordon site (Coles Creek type site of J. A. Ford), near Fayette, Miss.* Charred vegetal specimens (charcoal, wood, grass, and so forth), from a burned floor level (F.S. 451, feature 4 house site) within a rectangular structure of vertical posts set in trenches and associated with a Plaquemine occupation. The site is 18 mi northeast of Natchez. Submitted by John L. Cotter. | M-30 | 350 ± 250 |
| *Newt Kash Hollow, Menifee County, Ky.* Desiccated grass and other plant material from a Bluff shelter which is a relatively homogeneous site attributable to early Woodland (*7*). The material used for the radio-carbon analysis was submitted by W. S. Webb of the University of Kentucky, for an ethnobotanical study by V. H. Jones of the University of Michigan. Jones' study has been published. (*7*). | M-31 | 2650 ± 300<br>2600 ± 300 |
| *Sapelo Island, McIntosh County, Ga.* Shell specimens from a late Archaic level with plain fiber-tempered pottery, overlain by ornamented pottery. Should date early fiber-tempered pottery period on the coast. Submitted by A. J. Waring, Jr., Savannah, Ga. | M-39 | 3600 ± 350<br>3800 ± 350<br>Average<br>3700 ± 250 |
| *Anna mound group, Adams County, Miss.* The charcoal sample was taken from high in the fill of mound 5; it represents a late occupancy of the site, which is located on bluffs overlooking a former channel of the Mississippi River, 8 mi north of Natchez. Submitted by John L. Cotter. | M-47 | 640 ± 250 |
| *Kolomoki, Early County, Ga.* Charcoal from a small fireplace at the eastern edge of a mass pottery deposit in mound D. Sequentially, the deposition of the sample fell about midway in the mound-building program, following two or three stages of fill or deposition, and followed by two or three stages. The sample was submitted (i) to check mound E sample (M-50) for culture-period date and (ii) to check the sequence within the local development. Submitted by W. H. Sears, University of Georgia. | M-49 | 1920 ± 300 |
| *Kolomoki, Early County, Ga.* Charcoal from burned timber over the central grave of mound E. It was covered by all of the mound fills but was placed after the grave fill. On the basis of ceramic typology, this sample should be slightly older than the mound D sample (M-49.) Submitted by W. H. Sears. | M-50 | 2120 ± 300 |
| *Spiro site, Le Flore County, Okla.* Wood from Craig burial mound, exact provenience unknown. Should equate with sample M-14, which came from the same site. Submitted by Robert E. Bell. | M-54 | 640 ± 250 |
| *Kays Landing, Humphrey County, Tenn.* Submitted by T. M. N. Lewis and M. Kneberg, University of Tennessee. | | |
| Antler from occupation of old land surface that was separated from a shell mound above by a 2-ft stratum of alluvium. The antler is from stratum IV at this site, which is part of the Early Kays Landing culture complex. | M-108 | 4750 ± 500 |
| River shells from the shell mound overlying the earlier occupation. This sample was from the upper portion of the shell mound, and is either contemporaneous with or just prior to the arrival of Baumer pottery at the site. Ledbetter culture complex. | M-109 | 4050 ± 300 |
| *Jaketown site, Washington County, Miss.* Solid charcoal from feature 92 (*8*). The origin of the specimen was north 22.3 m, east 0.5 m at an elevation of 111.79 ft (10.30 ft below the surface). This is level U in square O–2 in Fig. 39b (*8*). It is well within the Poverty Point cultural deposits. Submitted by William G. Haag, Louisiana State University. | M-216 | 2830 ± 300 |

| Description | Sample No. | Age (yr) |
|---|---|---|
| *Taney Bluff shelter, Taney County, Mo.* Vegetal material from level-2 collections. Excavated by Carl Chapman, University of Missouri. Submitted by V. H. Jones from samples submitted for ethnobotanical analysis. | M-255 | 200 + 250 − 200 |
| *Kays Landing site, Humphrey County, Tenn.* Antler specimens from the upper portion of the site. Should date late Archaic. Submitted by T. M. N. Lewis and M. Kneberg. | M-356 | 3580 ± 300 |
| *Eva site, Benton County, Tenn.* Antler specimen to date the Eva complex, the earliest known Archaic in western Tennessee. Submitted by T. M. N. Lewis and M. Kneberg. | M-357 | 7150 ± 500 |
| *Manny site* (22-M-6), *Issaquena County, Miss.* Collected by James B. Griffin, University of Michigan, from excavations by Robert Greengo, Peabody Museum, Harvard University. | | |
| Charcoal from the west wall of cut V, level 40 to 60 cm. It is definitely later than the Issaquena complex and is probably Coles Creek in time. | M-382 | 640 ± 250 |
| Mussel shells from the lower levels of the midden debris of cut V. They should date the Issaquena (Mark-Troy) complex. | M-383 | 2420 ± 300 |
| *Manny site* (22-M-6), *Issaquena County, Miss.* Part of a charred log (southern yellow cedar) from cut Y, levels 6 to 9, from 60 to 100 cm deep. Collected by Robert Greengo. This should date the Coles Creek level. | M-384 | 770 ± 250 |
| *Nodena, Arkansas County, Ark.* Charcoal fragments of willow (*Salix*) from excavations made by James K. Hampson, Wilson, Ark. They should date within the well-advanced Middle Mississippi occupation of this site. Submitted by Hampson through James B. Griffin. | M-385 | 630 ± 250 |
| II. *Northern Mississippi Valley* | | |
| *Pool site, Pike County, Ill.* Assorted shells from pit debris in Hopewell village site. The sample is from the earlier occupation. It is what would be called early middle Hopewell, and it is associated with the Havana, Pool, and other stamped types. Submitted by John C. McGregor, University of Illinois. | M-15 | 2500 ± 300* |
| *Drake mound* (Fa 11), *Fayette County, Ky.* Bark preserved by contact with copper reel-shaped breast plate in association with burial No. 7, lying on the bottom of the pit, the central feature of this Adena Site. This sample is the same as University of Chicago sample C-126, which was dated 1168 ± 150 yr. It was collected by W. S. Webb and turned over to the University of Michigan for comparative purposes. | M-19 | 2200 ± 250 |
| *Havana, Ill.* Wood from mound 9 which was submitted by Thorne Deuel, Illinois State Museum, to the University of Chicago laboratory. It was processed there (sample C-152), and the age was found to be 2336 ± 250 yr. A prepared carbon sample from the University of Chicago was presented to the University of Michigan. | M-20 | 2200 ± 250 |
| *Madison County, Ill.* Charred miscellaneous plant material from a pit underneath the slope of mound 34, Cahokia mound group. The sample was submitted by James B. Griffin. | M-33 | 700 ± 300*<br>900 ± 300*<br>Average<br>800 ± 200 |
| *Washtenaw County, Mich.* Experiment to determine whether aquatic vegetation and contemporaneous marl from a fresh-water lake checked as to $C^{14}$ age (*9*). The material was collected by Stanley A. Cain, University of Michigan. | | |
| Recently deposited marl. | M-34 | < 200 |
| Aquatic vegetation from the same location. It was living when it was collected. | M-35 | < 200 |
| *Effigy Mounds National Monument, McGregor, Iowa.* Charcoal from a conical mound (No. 55). The site contained evidence of cremations as well as Hopewellian blades and a bear canine ornament. Excavated by Paul Beaubien (*10*), National Park Service. | M-40 | 900 ± 300* |
| *Effigy Mounds National Monument, McGregor, Iowa.* Charcoal from Effigy mound No. 30. There is no evidence of a burial in this bear or buffalo mound, but some charcoal and a layer of nondescript rocks are present. Excavated by Paul Beaubien (*11*). | M-41 | 930 ± 300* |
| *Brems site, Starke County, Ind.* Charcoal from two different pits eroding out of dunes. This site contains a wide range of evidence of Woodland and late-Mississippi period occupation. Collected by George Birdsell, South Bend, Ind., and submitted by J. B. Griffin. | M-48a<br>M-48b | 1400 ± 300<br>500 ± 250 |
| *Orleton Farms, Madison County, Ohio.* Wood from immediately underneath a mastodon skeleton in a marl layer about 2 ft 8 in. below the surface. Submitted by Raymond S. Baby and Edward S. Thomas, Ohio State Museum. | M-66 | 8420 ± 400*<br>8460 ± 400*<br>9600 ± 500 |
| *Woods site, Clay County, Kan.* NW¼ of the NW¼, section 34, T 9S, R4E. Charcoal from an Upper Republican site in the middle period of the development of this culture. Field specimen Col. 2829. Collected from the floor of an earth lodge. Submitted by Carlyle Smith, University of Kansas. | M-113 | 780 ± 150 |
| *Kossuth County, Iowa.* WC of section 22, T100N, R28W. Bones of *Equus* imbedded in lake silt associated with the Algona moraine, the youngest Mankato end morainal system in Iowa. Submitted by Robert Ruhe, Iowa State College. | M-115 | 100 ± 250 |
| *Graham Cave, Montgomery County, Mo.* The samples from Graham Cave come from cultural horizons representing stages within one culture complex which is in the process of change from an Early-Man hunting complex to an Archaic hunting-foraging complex with more emphasis upon foraging. There is no good evidence of any significant changes in the economy from the cave floor to level 4 at this part of the cave. The greatest change appears to be in the projectile points, which are more varied in form in the upper levels. Use of the cave by different wandering | | |

| Description | Sample No. | Age (yr) |
|---|---|---|
| bands of hunters, or close cultural contact by one band with numerous others, might be explanations for this apparent difference. In general, levels 4 through 6 on the west side of the cave appear to represent one complex. The samples were submitted by Carl Chapman, University of Missouri. | | |
| Charcoal and bone. 23 MT 2-Graham Cave. NW⅛-Sq. 10 L3, depth from datum 6 to 7 ft, level 6, from fireplace on original cave floor. This is a thin, distinct level in parts of the deposit. The fireplaces on the old cave floor include, in association with them, lanceolate projectile points [Graham Cave fluted and Dalton (Meserve)] plus some basal-notched and side-notched projectile points, basal-thinned, expanding-base drills, plano-convex scrapers, curved or straight-sided blades, sandstone mortars and cupstones, palettes or thin flat mealing stones, split-bone awls, a roller pestle, and a flaked-hematite adz. The horizon may mark a change from an Early-Man hunter-gatherer to Early-Archaic hunter-forager complex, for there is a greater variety of projectile point types, some of which occur consistently in the eastern Archaic, than are reported from Early-Man sites. | M-130 | 9700 ± 500 |
| Charcoal and bone. 23 MT 2-Graham Cave. NW¼-Sq. 10 L3 datum depth 6 to 7 ft, level 6 in compact, wind-blown soil and above the fireplace level of the cave floor. The associated cultural complex may differ from that on the cave floor, but if so, primarily in the addition of a greater variety of projectile point forms such as corner-notched and stemmed. Side-notched projectile points may occur in great numbers. A perforated-shell pendant and a coiled basketry impression on clay were found at this level elsewhere in the cave. The serrated flake knives are distinctive but may be a continuation from the lower horizon. The complex is not readily separable from that on the cave floor. | M-131 | 8830 ± 500 |
| Charcoal and bone. 23 MT 2-Graham Cave. NW¼-Sq. 10 L3, depth from datum 4 to 5 ft, level 4, still in compact, wind-blown deposit, but definitely later. The associated complex consists of a wide variety of side-notched, stemmed, basal-notched, and corner-notched projectile points and a relatively small number of lanceolate forms. The full grooved ax appears for the first time and bone artifacts are of more frequent occurrence, but otherwise the complex is similar to that of level 6. Owing to the heavy accumulation of wind-blown material on the west side of the cave where this sample was taken, it is probable that there is a shorter time interval between the levels here than there is in other parts of the cave, and it is not certain, for example, that the grooved ax found nearer the center of the cave is of comparable age. | M-132 | 7900 ± 500 |
| *Cromwell, Noble County, Ind.* Wood associated with the "Richmond mastodon." Submitted by Irving G. Reiman, University of Michigan, and Everett Burmaster, Irving, N.Y. | M-138 | 5300 ± 400 |
| *Calhoun County, Ill. Busycon* shell dipper from the Knight site, mound No. 8, found under limestone slabs at a depth of 6 ft. It should be the same age as the Hopewell material from the mound, including the famous figurines. Submitted by P. F. Titterington, St. Louis, Mo. | M-164 | 1700 ± 300 |
| *Pool site, Pike County, Ill.* Charcoal from within a vessel of the type Baehr Brushed in section V and area A3. Submitted by J. C. McGregor. | M-183 | 1740 ± 250 |
| *Effigy Mounds National Monument, Allamakee County, Iowa.* Mound 33 of the Sny-Magill group. This mound is regarded as representative of the late Hopewell period. Submitted by W. D. Logan, National Park Service. | M-310 | 1750 ± 300 |
| *Atchison County, Kan.* Peat from an artesian marsh at the 37-ft level, where pollen is chiefly *Abies* and *Tsuga*. The raised artesian marsh from which the material for this study was obtained is located at the east edge of the flood plain of the Delaware River, 1.5 mi south of Muscotah in the NE¼ sec. 16, T6S, R17E. Submitted by W. Horr, University of Kansas. | M-352 | 15,500 ± 1500 |
| III. *Great Lakes and northeastern United States* | | |
| *Lamoka Lake, Schuyler County, N.Y.* Charcoal lumps from under 5 ft of undisturbed refuse. Submitted by W. A. Ritchie, New York State Museum, to the University of Chicago laboratory, which later presented this extra charcoal to Michigan for comparative purposes. Two Chicago runs gave ages that averaged 4369 ± 200 yr. Compare also with sample M-195. | M-26 | 3650 ± 700*<br>4300 ± 700*<br>5380 ± 700*<br>Average<br>4440 ± 400 |
| *Snell site, Johnsville, Montgomery County, N.Y.* Charcoal from pit 12. Should date early Owasco culture. Excavated in 1949 by the Rochester Museum of Arts and Sciences in cooperation with the New York State Museum. Submitted by W. A. Ritchie. | M-28 | 1670 ± 300 |
| *Williams mound, near Akeley, Warren County, Pa.* Charcoal from pit 2, section 13, lens 30 to 33 in. below the surface of the mound. This is a Hopewellian site. Submitted by A. K. Guthe, Rochester Museum of Arts and Sciences. | M-51 | 2800 ± 300 |
| *Williams mound, near Akeley, Warren County, Pa.* Charred wood from 13 in. below the surface in section 14, probably the result of the burning of a tree stump. Submitted by A. K. Guthe. | M-52 | 250 ± 200 |
| *Washtenaw County, Mich.* Fragments of mastodon tusk, partly mineralized from outwash sand and gravel. Found 12 mi southwest of Ann Arbor. Identified and submitted by Claude W. Hibbard, University of Michigan. Acid-soluble carbonates were used for the sample. | M-67 | 6100 ± 400*<br>6300 ± 500 |
| *Ellsworth Falls, Hancock County, Me.* Smith farm. Two charcoal samples submitted by Douglas S. Byers, Peabody Foundation, Phillips Academy, Andover, Mass. (*12*). | | |

| Description | Sample No. | Age (yr) |
|---|---|---|
| Square D 2/100, pit 35 to 38 in. deep. Archaic level associated with rubbed slate and large, coarse, chipped cleavers. | M-89 | 4150 ± 450<br>3800 ± 400<br>Average<br>3975 ± 300 |
| Square C /8-14, pit 20 to 22 in. below the reference mark. Belongs to the later stages of Archaic. Pottery of the Vinette 1 type was not far above. | M-90 | 3350 ± 400 |
| *Sodom Lake, Oakland County, Mich.* Borings from the lake bottom. The samples from the 22-ft (M-162) and 23-ft (M-163) levels were combined. Submitted by Stanley A. Cain. | M-162, M-163 | 7000 ± 400 |
| *Muskalonge Lake site, Jefferson County, N.Y.* Charcoal from burned rock feature overlying Point Peninsula burial pit. The stone feature is definitely subsequent to the burial pit, and the date is inconsistent with the findings on other sites of this culture. Collected and submitted by W. A. Ritchie. | M-175 | 650 ± 250 |
| *White site, Norwich, Chenango County, N.Y.* Charcoal found by Theodore Whitney, New Berlin, New York, with partially cremated skeleton accompanied by grave goods. The site is very early Owasco with marked transitional features from Point Peninsula and is highly significant from the point of view of cultural continuity. Submitted by W. A. Ritchie. | M-176 | 1050 ± 250 |
| *Willow Tree site, Herkimer County, N.Y.* Charcoal from the lower level (32 to 40 in. deep) of shell midden 1. Very early Owasco culture. Submitted by W. A. Ritchie. | M-177 | 1000 ± 250 |
| *Castle Creek site, Broome County, N.Y.* Charcoal from pit 138, from section excavated by the Broome County Historical Society. Late Owasco culture. Submitted by Foster Disinger, Binghamton, N.Y., through W. A. Ritchie. | M-179 | 520 ± 200 |
| *Killarney Bay, Ontario.* Charcoal from site KB 1. From a narrow streak of black sand and charcoal apparently carried from the bottom of a hearth by wave action. Should date Point Peninsula in this area. The beach is at an elevation of 27.3 ft above Lake Huron. The hearth was about 26 ft above the lake. Collected and submitted by E. F. Greenman, University of Michigan. | M-194 | 2180 ± 300 |
| *Lamoka Lake, Schuyler County, N.Y.* From a hearth situated in sand and gravel under 3 to 4 ft of refuse midden in the north field of the Lamoka Lake site. Collected by A. F. Barrott in 1941 and submitted by W. A. Ritchie. | M-195 | 4530 ± 400 |
| *Leelanau County, Mich.* Humus from station No. 2, Sleeping Bear sand dune, located on top of a valders moraine. Significant because of its association with the prairie vole (*Microtus ochrogaster*), which is now found only in extreme southwestern Michigan. Collected and submitted by W. O. Pruitt, Jr., University of Michigan. | M-208 | 730 ± 250 |
| *George Reserve Lake, Livingston County, Mich.* Lake-bottom muck. Used for both pollen analysis and radiocarbon dating. Collected by Stanley A. Cain. | | |
| Muck from a depth of 30 to 31 ft. | M-222 | 8570 ± 400 |
| Muck from a depth of 35 to 36 ft. | M-223 | 11,450 ± 600 |
| Muck from a depth of 40¼ to 41¼ ft. | M-224 | 11,450 ± 600 |
| *Gibraltar site, Wayne County, Mich.* Charred corncobs in deposit 2, a pit 16 in. in diameter and 21 in. deep. The sample was not associated with any other material. The corncobs are of the eastern type. Submitted by E. F. Greenman. | M-228 | 350 ± 200 |
| *Lenawee County, Mich.* J. W. Bruggeman farm, sec. 5, T8S, R2E. Wood from a location immediately above a mastodon tusk. Submitted by Claude Hibbard. | M-282 | 9568 ±1000 |
| *South Haven site, Van Buren County, Mich.* Peat and wood on the east shore of Lake Michigan from a wave-cut exposure of buried peat bog interbedded with lacustrine deposits of glacial Lake Chicago and later lake sediments (*13*). Submitted by James H. Zumberge, University of Michigan. | | |
| Peat from the lowest 2 in. of the 30-in. peat layer. This sample dates the time when the waters of Lake Algonquin had already begun to drop to the Lake Chippewa level. The date is thus a minimum for Lake Algonquin and for the time that the North Bay outlet became ice-free. Judging from the pollen at this level in the peat, the waning phase of the spruce-fir period in the South Haven latitude is also coincident with this event. | M-288 | 8350 ± 500<br>7500 ± 500<br>Average<br>7925 ± 350 |
| Wood from the top of the basal blue silt. This sample dates the Bowmanville low-water phase in the Lake Michigan basin. | M-288a | 11,200 ± 600 |
| Peat from 7 in. above the base of the 30-in. peat layer, stratigraphically above the location of sample M-288. A post-Algonquin, pre-Chippewa date. According to the pollen profile of the South Haven peat, this sample also dates the pine period. | M-289 | 6330 ± 400 |
| Wood from the central part of the 30-in. peat layer. The date is interpreted as a date for the minimum level of Lake Chippewa in the Lake Michigan basin. According to the pollen at this level of the peat, this date marks the oak-pine period at the South Haven latitude. | M-290 | 5000 ± 400<br>5185 ± 400<br>Average<br>5090 ± 300 |
| From the upper 2 in. of peat in the exposure. Marks the time just before dune activity was renewed as a result of the return of the water from the Chippewa low-water phase to the Nipissing stage. This date thus just precedes the Nipissing maximum and, according to the pollen at this level, just precedes the Xerothermic period (oak-pine-hemlock-broadleaved forest in the South Haven latitude). By inference, then, the Nipissing stage and the Xerothermic period were coincident. | M-291 | 4000 ± 300<br>4000 ± 350<br>Average<br>4000 ± 250 |
| *Flint, Mich.* Wood taken from the top of a marl pile during excavation for a pond: 1 ft of muck and 5 ft of marl. Associated with caribou. Collected by the late C. M. Barber, Genesee County Museum. Submitted by William H. Burt, University of Michigan. | M-294 | 5870 ± 300 |
| *Isle Royale, Keewenaw County, Mich.* Pieces of white or black spruce from a location 70 in. deep in a pit of excavation for native copper, Minong | M-320 | 3000 ± 350 |

| Description | Sample No. | Age (yr) |
|---|---|---|
| Mines area, McCargoe Cove. Should give the date of Indian mining in this particular pit. Collected by Roy W. Drier, Michigan College of Mining and Technology, and James B. Griffin. See also sample M-371e. | | |
| *Two Creeks, Wis.* Log collected in 1952 by James H. Zumberge and Stephen H. Spurr, University of Michigan. | | |
| Outer portion of log. | M-342 | 10,700 ± 600 |
| Inner portion of log. | M-343 | 10,400 ± 600 |
| *Ellsworth Road, near Stone School Road, Washtenaw County, Mich.* Charcoal associated with late Woodland Indian burials. The sample was insufficient to fill the counter. Submitted by E. F. Greenman. | M-344 | < 400 |
| *Steuben County, Ind.* Sample of wood from late Cary deposits, ¼ mi beyond the distal slope of the Wabash moraine. Should be the same as U.S. Geological Survey samples W-57, which dated 12,380 ± 370 yr, and W-65, which dated 13,020 ± 400 yr. Submitted by James H. Zumberge. | M-350 | 12,600 ± 600 |
| *Ontanogan County, Mich.* Main drift of the new White Pine Copper Mine. Fragment of log buried under 80 ft of red lake clays, presumably from glacial Lake Ontanagon in Upper Michigan. Should date the early stages of Lake Duluth in Superior basin. Submitted by J. H. Zumberge and R. C. Hussey, University of Michigan. | M-359 | 10,220 ± 500 |
| *Isabella County, Mich., near Mount Pleasant.* Fragment of a log found during the digging of a pond at depth of 3 to 8 ft. Top level (3 ft of topsoil and muck) was underlain by 8 ft of raw peat in which wood and other plant materials were frequent; this in turn rested on a layer of blue clay. Collected by Daniel J. Balog, U.S. Soil Conservation Service, Mount Pleasant. Submitted by James H. Zumberge. | M-360 | 7470 ± 500 |
| *Lake Nipissing, Ontario.* Charcoal from the Frank Bay site. This deposit is from just above the high-water erosion mark on the Lake Nipissing shore. It should date the preceramic Mattawan complex (*14*). Submitted by Frank Ridley, Toronto, Ontario. | M-363 | 2920 ± 300 |
| *Isle Royale, Keewenaw County, Mich.* Charred log section from the same pit as sample M-320 but from 11 to 12 ft deep. Submitted by Roy W. Drier. | M-371e | 3800 ± 500 |
| *Calvert County, Md.* Charcoal from site 18An18. This was a cremation ground with Ohio pipestone tubular pipes and other indications of a connection with the Adena culture. Submitted by T. L. Ford, Archaeological Society of Maryland. | M-419c | 1700 ± 250 |
| IV. *Western United States and northern Mexico* | | |
| *Crater Lake, Ore.* Charcoal from trees buried by eruption of Mount Mazama. Same as University of Chicago sample C-247, which on the basis of four runs gave dates that averaged 6453 ± 250 yr. This was a reduced carbon sample obtained from the Chicago laboratory for comparative purposes. | M-21 | 6000 ± 700*<br>7000 ± 700*<br>Average<br>6500 ± 500 |
| *Willow Beach site, near Lake Mead, Ariz.* Submitted by Albert H. Schroeder, National Park Service, Globe, Ariz. | | |
| Charcoal from layer B, Ceramic culture, pottery not accurately datable. | M-42 | 500 ± 250* |
| Samples from layers F–G, in stone-bearing (nonpottery) level beneath pottery-bearing layer. One of three distinct nonpottery levels. | M-43 | 1170 ± 300*<br>1500 ± 250<br>Average<br>1335 ± 200 |
| Sample from layer J, one of three distinct nonpottery levels. | M-44 | 1700 ± 250 |
| Sample from layers N–O, lowest levels of occupation. | M-45 | 1210 ± 300*<br>2200 ± 250 |
| *Bute Inlet, British Columbia.* Fatty wax oozing up on beaches. Apparently it is a wax of vegetable rather than animal nature. The question is whether it is contemporary or whether it comes from under glaciers. Submitted by Lyle A. Swain, Fisheries Research Board of Canada, Vancouver, British Columbia. | M-68 | < 300 |
| *West Berkeley, Alameda County, Calif.* Charcoal from large shell mound on the east shore of San Francisco Bay. The mound is probably the earliest one yet excavated in that region. Submitted by W. J. Wallace, University of Southern California. | | |
| Charcoal in level between 96 and 108 in. | M-121 | 2200 ± 400<br>2700 ± 300 |
| Charcoal in level between 132 and 144 in. | M-122 | 3210 ± 300 |
| Charcoal in level between 144 and 156 in. | M-123 | 2880 ± 300 |
| Charcoal in level between 156 and 168 in., west side. | M-124 | 3500 ± 300<br>3700 ± 350 |
| Charcoal in level between 156 and 168 in., east side. | M-125 | 3860 ± 450 |
| Charcoal in level between 180 and 192 in. | M-126 | 3140 ± 300 |
| Charcoal in level between 192 and 204 in. | M-127 | 2700 ± 400<br>3700 ± 300 |
| *Frightful Cave* (CM68), *Coahuila, Mexico.* The site is 15 mi southeast of Cuatro Cienegas. Collected and submitted by W. W. Taylor, Jr., Santa Fe, N.M. The "bottom level" specimens came from the lowest 50 cm, which contains the Cienegas complex and the later Coahuila complex. The "top level" contained only the Coahuila complex, which is *generically* related to the Pecos River focus of the Big Bend aspect. | | |
| Twill-pad sandals restricted to the bottom level. | M-184 | 7300 ± 400 |
| Human feces from the top level. | M-185 | 3620 ± 300 |
| Human feces from the bottom level. | M-188 | 8023 ± 350 |
| Wood fragments from the bottom level. | M-191 | 8870 ± 350 |
| *Danger Cave, Tooele County, Utah.* Submitted by Jesse D. Jennings, University of Utah. As a result of radiocarbon dates, all the previous interpretations of Pleistocene lake history, depth, and position in geologic time must be reassessed. The Danger Cave specimens are among the most complete from any early site. The cultural material from Danger Cave shows strong west-coast, western-desert affiliations. Well represented in the collection are (i) projectile points and knives found in the Pinto basin and Mohave Desert | | |

| Description | Sample No. | Age (yr) |
|---|---|---|
| generally, on the one hand, and (ii) other types normally recovered in great numbers from the caves of Oregon on the other. It is also quite important to note that, at the McKean site in the northern Great Plains, specimens quite comparable to or identical with some of the Danger Cave specimens have been recovered. Numerous basketry fragments, several hundred flat slab metates, and a wide range of specialized flint tools indicate that, as early as 7000 B.C., there was a well-developed, specialized desert culture devoted to exploitation of the total floral and faunal offering of the environment. Small seeds were gathered in season, parched or charred, and ground, evidently in some quantity. Plain twining from level 11 is the earliest basketry technique. Coiling becomes common in level 11, and techniques generally proliferate thereafter. The culture is interpreted by Jennings to demonstrate no great difference from the general Shoshone way of life observed as late as A.D. 1850 (*15*). | | |
| Mountain sheep dung from a sand dune resting on beach gravels in the mouth of the cave. On the sand is a layer of occupation material 11 ft in depth. Same as University of Chicago sample C-609, which was dated 11,453 ± 600 yr. | M-118 | 11,000 ± 700 |
| Twigs resting on the same sand dune as sample M-118. Same as University of Chicago sample C-610, which was dated 11,151 ± 570 yr. | M-119 | 10,400 ± 700 |
| Charcoal from feature 108 in square 130L5–135L5, from a low level in the cave. | M-202 | 10,270 ± 650 |
| Uncharred organic materials from feature 22, 140 face, in one of the uppermost strata in the site. | M-203 | 4000 ± 300 |
| Slightly charred sheep dung from feature 19 in one of the lowest levels in cave. | M-204 | 10,270 ± 650 |
| Uncharred organic material from feature 17, 140 face, lying just beneath feature 22; see sample M-203. | M-205 | 4900 ± 350 |
| *Cochise County, Ariz.* Charcoal from a fire hearth about 15 ft below the present surface in a vertical bank of the San Pedro River in NE ¼ sec. 5, T16S, R20E, Gila and Salt River meridian. Submitted by W. S. Fulton, Amerind Foundation, Inc., Dragoon, Arizona. | M-230 | 2450 ± 300 |
| *Sandia Cave, Bernalillo County, N.M.* Fragments of ivory from the Sandia level in the cave. Submitted by Frank C. Hibben, University of New Mexico (*5, 16*). | M-247<br>M-349 | > 20,000<br>> 20,000 |
| *Sandoval County, N.M.* Charcoal from a deeply buried site near Santa Ana Pueblo, in the No.-2 terrace fill. The artifact assemblage is similar to that in the last two stages of the Cochise series. The site may be a semi-pithouse. According to Ernst Antevs, the site should be between 2000 and 4000 yr old. Submitted by Frank C. Hibben. | M-248 | 3100 ± 500 |
| *Sandoval County, N.M.* Charcoal from a surface hearth in the same site as sample M-248, but not in the same stratum. Submitted by Frank C. Hibben. | M-250 | 2500 ± 350 |
| *Rio Puerco crossing, N.M.* Charcoal from a cave in small lava butte near Rio Puerco crossing. The artifacts appear to be of the San Pedro phase of Cochise culture. Submitted by Frank C. Hibben. | M-251 | 680 ± 250 |
| *Angostura basin, S.D.* Sites 39FA68–153 and 39FA68–145. These are composite samples of small and fairly large pieces of charcoal obtained in 1949 from a layer of charcoal-stained sand uncovered in trench B, square 2. The layer envelops rock hearths, one complete McKean point, and two proximal fragments of McKean points. Collected by R. M. Wheeler and submitted by F. H. H. Roberts, Jr., River Basin Surveys, Smithsonian Institution. | M-368<br>M-369 | 3630 ± 350<br>4230 ± 350 |
| *Angostura basin, S. D.* Site 39FA65–382. Ray Long site. A composite sample of hundreds of minute pieces of charcoal was taken from the matrix of a massive weathered-clay, shale zone that contained unlined hearths and Angostura points *in situ*. Collected in 1950 at area A of the Ray Long site by R. M. Wheeler and submitted by F. H. H. Roberts, Jr. | M-370 | 9380 ± 500 |
| *Midland County, Tex.* Turtle bones and other bones from the white sand at the "cut bone" locality, at the Midland Man site (*17*). Submitted by E. H. Sellards, Texas Memorial Museum. | M-388 | 8670 ± 600 |
| *Midland County, Tex.* Concentrated carbon obtained by W. D. Armstrong, University of Minnesota, from animal bone from the grey sand at the Midland Man site, and believed to be approximately contemporaneous with the human fossils (*17*). Submitted by E. H. Sellards. | M-411 | 7100 ± 1000 |
| V. *Northern North America* | | |
| *Agattu Island, Aleutians.* Unworked scraps of wood from midden at Krugloi Point, excavation unit 4, bottom of muck, depth 7 to 10.5 ft. Submitted by A. C. Spaulding, University of Michigan. | M-12 | 2500 ± 300*<br>2630 ± 300* |
| *Fairbanks region, Alaska.* Cut from wood found 90 ft below the surface in a gold placer-mining pit. Collected by Otto W. Geist, University of Alaska. Submitted by Claude Hibbard. | M-37 | 18,300 ± 2000* |
| *Fairbanks region, Alaska.* Large bison (*Bison crassicornis*) horn sheaths taken from gold-bearing gravels by Otto W. Geist. Submitted by Claude Hibbard. | M-38 | 16,400 ± 2000* |
| *Aleutian Islands.* Collected and submitted by T. P. Bank III, University of Michigan. | | |
| Kagamil Mask Cave, Kagamil Island. Uncharred wood from Aleut burial cave containing painted wooden masks. Taken from surface at rear of cave. The associated skeletal material is characteristic of recent Aleut. | M-91 | 1660 ± 300 |
| Kagamil Cold Cave, Kagamil Island. Cordage and wood from Aleut burial cave. The sample was taken from the forepart of cave at a level 2 ft below the present earthen floor. This is the cold cave from which the 1936–38 Ales | M-92 | 900 ± 300 |

| Description | Sample No. | Age (yr) |
|---|---|---|
| Hrdlička collections came. These collections are now in the U.S. National Museum. | | |
| Lash Bay, Tanaga Island. Tanaga profile A. Humus intercalated between volcanic ash layers from site A. The sample was taken from a depth of 1.83 m (lower middle soil zone). The associated fossil pollen indicates vegetation more characteristic of a climate that was colder and dryer than the present climate. It may mark the beginning of amelioration in the postglacial development of the thermal maxium. | M-93 | 4900 ± 400 |
| Kagamil Island rock shelter. Bird skin, feathers and matting from Aleut burial shelter. Taken from charred, mummified remains of human infant burial at the surface of a volcanic crevice. This sample agrees in age with sample M-92. The shelter is probably contemporaneous with burials in the nearby warm cave that was visited in 1936–38 by Ales Hrdlička. | M-94 | 980 ± 250 |
| *Mould Bay, Prince Patrick Island, District of Franklin, Canada.* Submitted by C. O. Handley, Jr., U.S. National Museum. | | |
| Wood specimens from Big Ragged Mountains, 5 mi northeast of the Mould Bay weather station, elevation 800 ft. The specimens were scattered through unconsolidated marine drift resting on bedrock. | M-116 | > 25,000 |
| Wood specimens from Walker Inlet watershed, near the divide 15 mi west of the Mould Bay weather station, elevation 700 ft. The specimens were in lenses below 50 to 100 ft of unconsolidated marine drift and lying weathered out of ridge tops. | M-117 | > 25,000 |
| VI. *Eurasia* | | |
| *Gumma Prefecture, Japan.* Wood (*Fraxinus mandchurica*) from depth of 14 ft in Ozegahara peat bog. The age of the peat bog is guessed at somewhere between 6000 and 12,000 years. Submitted by Hiroshi Hara, Botanical Institute, Faculty of Science, University of Tokyo. | M-53 | 5678 ± 700 |
| *Yunnan Province, China.* Charcoal taken from the inside of a bronze Buddhist statue said to be from Yunnan Province, the date of which has been somewhat problematical. Submitted by A. G. Wenley, Freer Gallery of Art, Washington, D.C. | M-217 | 1500 ± 250 |
| *Chiba Prefecture, Japan.* Wood fragments from the Kamo site, Toyodamura, Arva-gun. The tentative date is 1500 to 2000 B.C. Submitted by R. K. Beardsley, University of Michigan, for the Japanese Archaeological Association. | M-240 | 5100 ± 400 |
| *Lolang, Korea, Wang Hsu's grave.* Wood from grave of the 12th year of Yung-P'ing or A.D. 69. Submitted by R. K. Beardsley for the Japanese Archaeological Association. | M-241 | 1850 ± 250 |
| *Tung-Ling site, Ch'ing-Chou, Manchuria.* Wood from a mausoleum attributed to the Liao Dynasty about 1100 A.D. Submitted by R. K. Beardsley for the Japanese Archaeological Association. | M-242 | 700 ± 250 |
| VII *Pacific islands* | | |
| *New Caledonia, east coast.* University of California expedition of 1952, E. W. Gifford and Dick Shutler, Jr., University of California, Berkeley. | | |
| Charcoal from a site a few miles south of Poindimie. The cultural material extended down to a depth of 96 in., but the only charcoal sample of sufficient size was in the 24- to 30-in. layer. University of California Museum of Anthropology (U.C.M.A.) No. 11-16362, site 6. | M-337 | 615 ± 300 |
| Charcoal from the modern aboriginal village of Tiouande, depth from 12 to 18 in. The cultural material extended down to 42 in. U.C.M.A. No. 11-16544, site 51. | M-338 | 385 ± 300 |
| Charcoal from peatlike material, 78 to 84 in. deep, near the mouth of the Tiouande River. The cultural material extended down to 90 in. U.C.M.A. No. 11-15237, site 50. | M-340 | 1880 ± 350 |
| *New Caledonia, west coast.* University of California expedition of 1952. E. W. Gifford and Dick Shutler, Jr. | | |
| Charcoal from depth of 36 to 42 in. on shore of Anse Longue. The cultural material extended to depth of 60 in. U.C.M.A. No. 11-15321, site 20. | M-332 | 1335 ± 300 |
| Charcoal from a depth of 24 to 30 in. on a low isthmus connecting the hilly parts of Foue Peninsula, 5 mi from the modern town of Kone. The cultural material extended down to 48 in. U.C.M.A. No. 11-15631, site 13. | M-341 | 2800 ± 350 |
| Charcoal from a depth of 30 to 36 in. in the same location as sample M-341. U.C.M.A. No. 11-16226, site 13. | M-336 | 2435 ± 400 |
| Charcoal from a depth of 42 to 48 in. on a hill slope at the edge of the Coral Sea about 1 airline mile west of site 13, on Foue Peninsula. The cultural deposit extended down to 78 in. U.C.M.A. No. 11-15660, site 14. | M-333 | 1700 ± 300 |
| Charcoal from a depth of 24 to 30 in. in a site in the modern aboriginal village of Ounjo on the rocky headland between the towns of Kone and Voh. The cultural deposit extended down to 78 in. U.C.M.A. No. 11-15788, site 26. | M-335 | 785 ± 300 |
| Charcoal from a depth of 30 to 36 in. in the same site where sample M-335 was collected. U.C.M.A. No. 11-15749, site 26. | M-334 | 905 ± 300 |
| *Viti Levu Island, Fiji; Vunda, Lautoka Province.* Vunda is the site of the traditional first settlement in Fiji (*18*). University of California expedition of 1947, E. W. Gifford. | | |
| Charcoal from a depth of 12 to 18 in. U.C.M.A. No. 11-6353, site 26. | M-373 | 650 ± 300 |
| Charcoal from a depth of 24 to 30 in. U.C.M.A. No. 11-6349, site 26. | M-374 | 700 ± 300 |
| *Viti Levu Island, Fiji; Navatu, Ra Province.* Near Narewa village, at the base of great crag Navatu (The Rock), are two deposits. At location B, the deposit was 12 ft deep; at location A, 10 | | |

| Description | Sample No. | Age (yr) |
|---|---|---|
| ft deep. The locations are about ¼ mi apart; B fronts on the sea, and A is inland a short distance. University of California expedition of 1947, E. W. Gifford. | | |
| Charcoal from a hearth on virgin soil at the bottom of a cultural deposit in a rock shelter. Location A, depth 30 in. U.C.M.A. No. 11-5810, site 17. | M-36 | 950 ± 300* |
| Charcoal from a midden in front of the rock shelter. Location A, depth 104 to 110 in. U.C.M.A. No. 11-6335, site 17. | M-351 | 2000 ± 500 |
| Charcoal from midden. Location B, depth 90 in. U.C.M.A. No. 11-5879, site 17. | M-367 | 1200 ± 500 |
| Charcoal from midden. Location B, depth 96 to 104 in. U.C.M.A. No. 11-6342, site 17. | M-350 | 1300 ± 500 |
| *Ulupalakua, Territory of Hawaii.* Charcoal from roots of a tree engulfed by a lava flow. Native legend is associated with same lava flow. Specimen collected and submitted by Grote Reber, Wailuku, Maui, T.H. | M-361 | 600 ± 300 |
| VIII. *Middle and South America* | | |
| *Monagrillo Site, Panama.* Assorted marine shells procured by Karl Curtis from the refuse pile of the Gordon R. Willey 1949 excavation. This site was considered by Willey in 1949 as contemporary with Formative levels in Middle America and South America. Submitted by Gordon R. Willey, Peabody Museum, Harvard University. | M-11 | 800 ± 250* |
| *Minas Gerais, Brazil.* Mae Rosa Cave (rock shelter). Collected by H. V. Walter, Minas Gerais. | | |
| Charcoal from a depth of 2 m associated with stone anvils and hand axes of early lithic complex. | M-212 | < 300 |
| Charcoal from a depth of 1 m. Both this sample and sample M-212 are from the same layer but different spots. A recheck of the strata and the conditions of collection suggests that there has been contamination by washing from more recent deposits. | M-213 | < 300 |
| *Quebrada Tocuyano site, State of Lara, Diubor Municipio, Venezuela.* Soil and charcoal. Submitted by J. M. Cruxent, Museum of Natural Sciences, Caracas, Venezuela. | M-257 | 2180 ± 300 |
| *Lagoa Funda, Minas Gerais, Brazil.* Material from this site should date the age of the extinct Giant Bear. Submitted by Clifford Evans, U. S. National Museum. | M-354 | 3000 ± 300 |


**References and Notes**

1. Financial support for the radiocarbon laboratory has been provided, since the beginning of the work, by the Michigan Memorial Phoenix Project.
2. I am especially indebted to two of the members of the curatorial committee, James B. Griffin and Volney H. Jones, for their constant help in the day-to-day operation of the project. A large share of the credit for building and testing the equipment belongs to E. W. McDaniel, who is now with the physics department at Georgia Institute of Technology. The chemical preparations of the samples were made by Patricia Dahlstrom and Gloria Thornton.
3. W. F. Libby, E. C. Anderson, J. R. Arnold, *Science* **109**, 227 (1949); J. R. Arnold and W. F. Libby, *Science* **110**, 678 (1949).
4. H. R. Crane, *Nucleonics* 9, No. 6, 16 (1951); H. R. Crane and E. W. McDaniel, *Science* **116**, 342 (1952).
5. H. R. Crane, *Science* **122**, 689 (1955).
6. I May, *ibid.* **121**, 508 (1955).
7. W. S. Webb and W. D. Funkhouser, "Rock shelters in Menifee County," *Univ. Kentucky Repts. Archaeol.* 3, No. 4 (1936).
8. J. A. Ford, P. Phillips, W. G. Haag, *Anthropol. Papers Am. Museum Nat. Hist.* **45**, part 1 (1955), Figs. 9 and 39b.
9. H. H. Bartlett, *Science* **114**, 55 (1951).
10. P. L. Beaubien, *Wisconsin Archeol.* **34**, No. 2, 125 (1953).
11. —— *Am. Antiquity* **19**, No. 1, 56 (1953).
12. D. S. Byers and W. S. Hadlock, *Science* **121**, 735 (1955).
13. J. H. Zumberge and J. E. Potzger, *Science* **121**, 309 (1955); *Bulletin Geol. Soc. Amer.* 67, 271 (1956).
14. F. Ridley, *Am. Antiquity* 20, No. 1, 40 (1954).
15. J. D. Jennings, "Danger Cave: A progress summary," *El Palacio* 60, No. 5, 179 (1953).
16. F. C. Hibben, *Science* **122**, 688 (1955).
17. F. Wendorf, A. D. Krieger, C. C. Albritton, *The Midland Discovery* (Univ. of Texas Press, Austin, 1955).
18. E. W. Gifford, *J. Polynesian Soc.* **64**, 240 (1955).

# News of Science

## Project Rockoon

The Naval Research Laboratory recently completed an unusual series of upper atmosphere experiments. Known informally as "Project Rockoon" [*Science* **124**, 213 (3 Aug. 1956)], the experiments were conducted with the objective of obtaining data on the strength of x-ray and ultraviolet radiations from solar flares. Ten flights were attempted as a preliminary to more extensive studies of solar flares during the International Geophysical Year (July 1957 to December 1958).

Solar flares are bright bursts of light emitted from individually active areas of the sun. The emissions reach a peak in a manner of minutes, but their effects may last for many hours. One of these effects is a partial or complete fadeout of radio signals of medium and short wavelengths.

A group of scientists under the direction of H. Friedman of the NRL optics division staged the experiments on the Pacific Ocean some 200 to 400 miles southwest of San Diego, Calif. Rockoons (rocket-balloon combinations) were launched from the *U.S.S. Colonial* on successive mornings during the 2-week period beginning 16 July. Members of the expedition included T. A. Chubb, J. E. Kupperian, Jr., R. W. Kreplin, W. A. Nichols, J. J. Nemecek, and D. Brousseau, all of NRL, and D. McNutt of the University of Wisconsin, A. Knudsen of Johns Hopkins University, and A. Unzicker of the State University of Iowa.

The Rockoon technique was originally developed by J. A. Van Allen of Iowa in cooperation with the Office of Naval Research. In all earlier experiments it had been the practice to hang a small rocket on a Skyhook balloon and permit the rocket to be fired by a pressure switch when it reached an altitude of between 60,000 and 80,000 feet. For the flare experiment the rocket was equipped with a radio relay receiver so that the firing circuit could be operated from the *Colonial*. The use of ground-controlled firings provided a practical solution to the problem of having the scientific instruments aloft coincident with the occurrence of a solar flare. Since these flares rise to a maximum in a few minutes, it is essential to accomplish as quickly as possible the threefold task of detecting the flares from the ground ( a ship in this instance), launching the rocket, and gaining the necessary altitude for scientific observation.

The choice of the experimental area was based on a number of considerations. The investigators had to choose an area away from auroral zones, which also cause radio disturbances, to insure that local radio fadeout observations could be correlated with solar flares. They had to stage their launchings away from established air lanes and at a spot so remote that the rockets would not fall on inhabited areas. From a weather standpoint, a stable high-pressure area with low surface winds was desirable to facilitate balloon launchings, and low winds (less than 15 knots) at high altitudes were desirable to minimize balloon drift. Good visibility from shipboard and adequate sun elevation above the horizon for at least 8 hours were also desirable. The only area that appeared to meet all of these criteria, and which was also within radio reception range of the observatories at Climax and Sacramento Peak, was the one selected on the Pacific. The destroyer *U.S.S. Perkins* supported the launching ship (*U.S.S. Colonial*) by tracking the Rockoon with its radar gear, and Navy patrol planes based at San Diego patrolled the rocket landing area to insure safety to shipping.

Helium-filled Skyhook plastic balloons, 72 feet in diameter, supported 12-foot long Deacon rockets that had been equipped with instruments by NRL. In addition to the telemetering transmitter, each rocket contained detectors (ionization chambers and photon counters) that were sensitive to radiation from the sun in three wavelengths—1216A, 1A to 10A, and 0.05A to 1A. These wavelengths correspond to the Lyman-alpha line of hydrogen, "soft" x-rays, and "hard" x-rays, respectively, which are believed to have independent but cumulative effects on the ionosphere, and hence on radio fadeouts.

One Rockoon was launched each morning and allowed to float above the ocean at constant altitude of 80,000 feet while the men aboard the *Colonial* waited to detect a flare by observing a sudden radio fadeout. A second method of flare detection designed by D. E. Billings, R. Lee, and G. Newkirk of the High Altitude Observatory at Boulder, Colo., made use of an optical telescope coupled to a closed-circuit television system, with a violet color filter corresponding to the light of the calcium K line in solar plage regions. Unfortunately, for the entire trip there was almost a solid cloud cover and the group aboard the *Colonial* never had a chance to view the sun with their telescope. This solar blindness, however, was compensated for by the good radio communications with Climax and Sacramento Peak observatories.

When the decision had been made to fire a rocket, coded signals from a shipboard transmitter turned on the electronic instruments in the nose section of the rocket, and also energized the receiver that controlled the rocket igniter. Within 1½ to 2 minutes after the rocket was fired, it reached an altitude of 60 to 70 miles above the earth (within the ionosphere), and data obtained by the rocket-borne instruments on the strength of x-rays and ultraviolet radiations from the flare were radioed back to the observing station aboard the ship.

At this time of year a flare of size Class 1 or greater may be expected to occur about once every 50 hours. For the 11 days from start to finish there were one Class-1 flare and two Class-2 flares. Both Class-2 flares showed up clearly on the fadeout detectors, but unfortunately they occurred on Sunday, which was the one day out of eleven that was not scheduled for a launching. It is clear from observations on the one which was detected that the solar flare process is certainly not confined to the emission of the Lyman alpha line in the region of ionizing wavelengths, and that x-rays play an important part in it.

The Class-1 flare was too weak to produce a radio fadeout but was detected visually by D. Hansen with a spectrograph at Climax. He sent this information to the *Colonial* by radio rapidly enough to permit firing the rocket while the flare was still in progress. Although the rocket reached altitude after the flash phase of the flare, the detectors indicated an unusually high intensity of x-rays extending to wavelengths as short as 3 angstroms. Furthermore, these x-rays were detected at 77 km, which is well within the D-region of ionization. At the same time the intensity of Lyman alpha was comparatively normal. It seems reasonable to expect that x-rays of wavelength as short as 1 or 2 angstroms would be produced in larger flares, and the intensity would be high enough to explain many of the hitherto puzzling details of solar-flare effects in the ionosphere.

The absence of any marked increase in Lyman alpha does not mean that this

radiation is absent in the flare. It may be that the enhancement of Lyman alpha occurs in the flash phase and the NRL rocket did not reach altitude early enough to detect the flash. It is interesting to note that the normal x-ray spectrum from a quiet sun implies a coronal temperature of about 700,000°K. The flare region that produced the 3-angstrom radiation must have been heated to perhaps 10 million degrees to account for the observed intensity.

These flare studies will be continued through the International Geophysical Year. Approximately 40 flights are planned, either with the Rockoon system or with the ground fired Dan, which is a combination of the Nike booster and the Deacon rocket.

## Blood Groups and Disease

A correlation between a person's blood group and the diseases to which he is susceptible was reported by J. A. Fraser Roberts of the London School of Hygiene and Tropical Medicine, at the recent annual meeting of the British Association for the Advancement of Science. Discussing the blood groups A, B, and O, Roberts cited the following three associations, which he said were supported by "overwhelming" evidence:

1) The incidence of duodenal ulcer is now known to be 40 percent higher in persons with group O blood than in those with other types of blood.

2) Gastric ulcer is 25 percent more common among members of the same group, and persons in group A appear to be abnormally susceptible to cancer of the stomach.

3) Persons with O or B blood are more than normally likely to get diabetes and pernicious anemia.

## USDA Animal Disease Laboratory Dedicated

The new $10-million research building of the U.S. Department of Agriculture's Plum Island Animal Disease Laboratory was dedicated on 26 Sept. The laboratory, which has been in limited operation since July 1954, is devoted to research on foreign diseases of livestock —particularly foot-and-mouth disease— that are potential threats to the U.S. livestock industry.

Following the public open house and dedication ceremonies there was a scientific symposium for invited specialists concerned with foreign livestock diseases. Among the scientists from abroad who participated were Ian A. Galloway, director of the Research Institute, Pirbright, Surrey, England; Jacob G. van Bekkum, State Veterinary Research Institute, Amsterdam, the Netherlands; Charles A. Mitchell, chief of the Animal Diseases Research Institute of the Canadian Department of Agriculture, Hull, Canada; Georges A. Moosbrugger, director of the Federal Vaccine Institute, Basel, Switzerland; and Erik G. Fogedby, Food and Agriculture Organization of the United Nations, Rome, Italy.

## Canadian Industry and the Scientific Manpower Shortage

At Canada's first national conference on engineering, scientific, and technical manpower, about 100 industrial leaders joined to create the Industrial Foundation on Education. The conference, held at St. Andrews, New Brunswick, was sponsored by the A. V. Roe Canada Ltd., an aviation company. Almost $100,000 was pledged to finance the new organization, and the first year's budget of $50,000 was underwritten by the Roe Company.

The aims of the foundation are: (i) to speak for industry in matters of education; (ii) to represent industry in any nation-wide program for training skilled manpower; (iii) to study the role of industry in education in general; and (iv) to engage in research in education in the light of industrial needs.

There have been increasing indications of a shortage in engineers and scientists as Canadian industry expands. Statistics show that Canadian schools are turning out about 1700 engineering graduates a year. One speaker at the conference estimated that Canadian industry requires 3000 a year, and another placed the figure at 6000, pointing out that in recent years Canada has filled many of its industrial engineering positions with immigrants. Approximately 8000 to 9000 professional men and women from abroad are taken into Canadian industry annually.

The creation of the Foundation on Industrial Education was the first action of its kind in Canada instituted by a cross-section of industry. Hitherto, the basic problems of education have been left to educators and to the provincial governments.

## Geological Survey Water Resources Division

Reorganization of the Water Resources Division of the Geological Survey has been announced. The revised structure is designed to integrate the program planning and the operations of the division, to decentralize its administration, and to improve facilities for the increasingly important general hydrologic studies. This in turn will permit a more effective utilization of the survey's scientists in basic research on the occurrence and behavior of water and in the interpretation of the basic water data.

The new organization plan for the division provides an assistant chief of division for operations, Raymond L. Nace; an assistant chief of division for program and development, Luna B. Leopold; an administrative officer in the immediate office of the division chief, Frank Barrick, Jr. In addition two field representatives of the division chief, to be known as division hydrologists, have been named: Arthur M. Piper for the Pacific Coast area, with headquarters at the Survey's field center in Menlo Park, Calif.; and George E. Ferguson for the Atlantic Coast area, with his office in Arlington, Va.

Two other division hydrologists for the Rocky Mountain and Mid-Continent areas will be named later. Within the division a new branch has been added, that of general hydrology, headed by Charles C. McDonald. Thus there are now four branches: ground water, surface water, quality of water, and general hydrology.

## Soviet Satellite Program

The U.S.S.R. confirmed the existence of its satellite program and made it officially part of the International Geophysical Year at the recent meeting in Barcelona, Spain, of the Comité Spécial de l'Anné Géophysique Internationale. This is the committee of some 50 nations that is coordinating the over-all plans for the IGY. The Soviet statement said only that a satellite program was being prepared, that it had begun quite recently, and that details could not be furnished until later.

## News Briefs

■ Supernovae may be the source of cosmic rays, according to a report by Philip Morrison of Cornell University on the findings of two Soviet scientists, Shklovsky and J. L. Ginzburg, and a Dutch astronomer, J. H. Oort. At the recent meeting in Seattle, Wash., of the International Congress on Theoretical Physics, Morrison stated that as result of their work, "the probable origin of cosmic rays has passed from the area of free speculation into one in which direct observation is brought to bear."

■ Research on the propulsion of rockets by nuclear energy is being conducted for the Atomic Energy Commission in two laboratories of the University of California—the Livermore Branch of the Berkeley Radiation Laboratory and the

Los Alamos Scientific Laboratory at Los Alamos, New Mexico. At Livermore the nuclear propulsion work is headed by Haydon Gordon and Theodore Merkle, and at Los Alamos by Raemer Schreiber.

■ The Power Reactor Development Company of Detroit has agreed to an Atomic Energy Commission hearing on whether or not its permit to build an atomic power plant at Monroe, Mich., should be suspended because of public hazard [*Science* **124**, 358 (24 Aug. 1956); **124**, 577 (28 Sept. 1956)].

■ For all cases where birth is delayed beyond 42 weeks, the prenatal mortality approaches 4 percent, according to Arne Lindell, of the Department of Women's Diseases, Karolinska Sjukhuset, Stockholm, in a paper presented at the ninth Congress of the Scandinavian Association of Obstetrics and Gynecology that took place recently in Oslo, Norway. Lindell based the finding on a study of more than 46,000 deliveries during the period 1943–52 inclusive. Most deaths among postmature infants occur during labor, and the most common cause of death is birth trauma, chiefly cerebral hemorrhage.

■ The ancient Russian city of Pskov, the foundation of which goes back some 1800 years, is being restored by Soviet archeologists and architects, according to the Soviet news agency Tass. The city fortress has 39 towers and walls that measure more than 5 miles in circumference.

■ Within the single decade following World War II, the child population of the United States increased by more than a third, reaching a record total of 55⅔ million at ages under 18 years in 1955. This 10-year gain of more than 14 million is without precedent in our history.

■ The Atomic Energy Commission has issued a license to the Naval Research Laboratory in Washington, D.C., to operate a "pool" type atomic reactor for use in research. This reactor, the first to be licensed in Washington, is similar in design to one that has been in operation for several years at Oak Ridge National Laboratory.

■ The National School of Health in Madrid, Spain, is setting up a new tissue-culture and virus laboratory for the Spanish Government. Herbert R. Morgan, chairman of the bacteriology department and director of the Rochester Health Bureau Laboratories, University of Rochester Medical School, has gone abroad to assist in the establishment of the new laboratory.

■ The United States has announced that it will make a special contribution of $1.5 million to the Pan American Sanitary Bureau for expanded assistance in 1957 in the malaria eradication campaign. This contribution is in addition to the regular annual quota payments of the United States and other member governments to the PASB budget.

■ The outlook in poliomyelitis, both immediate and long range, appears favorable, according to the statisticians of the Metropolitan Life Insurance Company. Through the first 8 months of 1956 reported cases of the disease are 45 percent fewer than in the comparable period of last year.

## Scientists in the News

H. GODWIN, author of *The History of the British Flora*, recently delivered this year's Woodward lectures at Yale University.

HERMAN I. SCHLESINGER, emeritus professor of chemistry at the University of Chicago, has been awarded the Alfred Stock memorial prize by the Society of German Chemists (Gesellschaft Deutcher Chemikur). He addressed the society at a meeting in Hamburg, Germany, on 21 Sept. Schlesinger, still active in research at the university, received the award for his work on the boron compounds, a field first explored by Stock, a German chemist, beginning in 1912. Schlesinger received his bachelor's and doctor's degrees from the University of Chicago, and he was a member of its faculty for 41 years until his retirement in 1948.

Mrs. ROBERT E. SHELBY, wife of the vice president and chief engineer of the National Broadcasting Company who died last December, was presented with the David Sarnoff gold medal that was awarded posthumously to her husband during the recent meeting of the Society of Motion Picture and Television Engineers.

FRANK E. E. GERMANN, who retired last year as professor of chemistry at the University of Colorado, has resigned as executive secretary-treasurer of the AAAS Southwestern and Rocky Mountain Division. He has accepted an appointment as physical chemist with the National Bureau of Standards in Boulder, Colo.

W. G. WADEY, formerly assistant professor of physics at Yale University, has accepted an appointment as professor of physics at Southern Illinois University, Carbondale.

JOHN W. KEMBLE, who since 1936 has been serving with the Army Medical Corps, and who during some of this time has been lecturer in neuroanatomy at George Washington University School of Medicine (Washington, D.C.), has been named professor of neurology at the Medical College of Georgia.

At the same institution, ARTHUR J. GATZ, former associate professor at Loyola University School of Medicine (Chicago), has been appointed associate professor of microscopic anatomy.

Foreign participants in the American Cancer Society's annual scientific session, which this year will take place 29–30 Oct. at the Park Sheraton Hotel in New York, include GUY F. MARRIAN of the University of Edinburgh, Edinburgh, Scotland; O. MÜHLBOCK of the Netherlands Cancer Institute, Amsterdam, Netherlands; RIGOBERTO IGLESIAS of the Institute of Experimental Medicine of the National Health Service, Santiago, Chile; SIR STANFORD CADE of Westminster Medical School, London, England; ROLF LUFT of the Karolinska Institut, Stockholm, Sweden; H. L. KOTTMEIER of the Radiumhemmet, Stockholm, Sweden; and ALFRED GLUCKSMANN of the Strangeways Research Laboratory, Cambridge, England.

A. M. LANE of the Atomic Energy Research Establishment, Harwell, England, is presenting a series of eight talks on the nuclear shell-model at Oak Ridge National Laboratory during the month of October.

The late GLADYS A. REICHARD, professor of anthropology who taught at Barnard College for 33 years, has been honored by the college with the publication of a booklet of tributes. Founder of the first anthropology department in a woman's undergraduate college, Dr. Reichard was an authority on the Navaho Indian. An analysis of Dr. Reichard's "Commitment to field work," by Margaret Mead, associate curator of ethnology at the American Museum of Natural History and a AAAS board member, is included in the publication, which may be obtained from the public relations office at Barnard.

V. PRELOG of the Technische Hochschule, Zurich, Switzerland, will discuss "Newer developments in the chemistry of medium-sized ring compounds," on 15 Oct. at Wayne University. This is the second in the series of eight weekly "Frontiers in Chemistry" lectures. The final lecture will be delivered on 3 Dec. by R. CRIEGEE of the Institut für Organische Chemie der Technischen Hochschule, Karlsruhe, Austria.

In celebration of BERNARD S. OPPENHEIMER's 80th birthday, friends have set up in his honor a fund to be administered by the Committee on Medical Education of the New York Academy of Medicine. The fund is for research in the field of medicine, for help to young men of outstanding promise, and for the advancement of medical education through lectures by eminent scholars.

VIRGINIA ARNOLD, formerly chief nurse in the Division of International Health, U.S. Public Health Service, has joined the staff of the Rockefeller Foundation as assistant director for medical education and public health. She has supervised USPHS nursing programs under the government's technical assistance programs in Latin America, the Near, Middle, and Far East, and Southeast Asia.

ROBERT S. WOODWORTH, emeritus professor of psychology at Columbia University, has received the American Psychological Association's first gold medal for distinguished achievement in American psychology. His textbook has been used by thousands of students, and for 60 years he has been an innovator and integrator of scientific psychology. Woodworth, who is 86 years old, still teaches a regular course.

Others honored during the recent annual meeting of the APA included KENNETH W. SPENCE of the State University of Iowa, for his work in attempting to develop a general theory of learning and behavior; CARL R. ROGERS, for his work in psychotherapy and its effects on personality and behavior; and WOLFGANG KOHLER, professor emeritus of Swarthmore College, for his investigations of the functional properties of perception.

EMANUEL R. PIORE has joined International Business Machines Corporation as director of research. He will head research being carried out in laboratories located in New York and California and in Zurich, Switzerland. A physicist, Piore was formerly chief scientist of the Office of Naval Research. His most recent post was research vice president for the Avco Manufacturing Corporation; he remains a consultant for that firm.

WALLACE GIVENS, formerly a consultant in mathematics at Oak Ridge National Laboratory and a professor at the University of Tennessee, has joined the mathematics department and computation laboratory of Wayne State University (Detroit). He is best known for his work in numerical methods used in the solution of large problems on electronic computers.

As a part of the centennial celebration of the University of Maryland, the university's department of physics is offering a special series of lectures entitled "The Centennial Lectures in Physics." The first five lectures, which took place between 24 Sept. and 2 Oct., were delivered by ALDUS SALAM of St. John's College, Cambridge, England; LEON C. VAN HOVE of the Institut voor Theoretische Fysica der Rijksuniversiteit, Utrecht, the Netherlands; ILYA PRIGOGINE of the University of Brussels, Brussels, Belgium; MAURICE H. L. PRYCE of the H. H. Wills Physical Laboratory, Royal Fort, Bristol, England; and FREDERICK REINES of the Los Alamos Scientific Laboratory, New Mexico, U.S.A.

JAMES STOKLEY, since 1941 a member of the General Electric Company's News Bureau in Schenectady, N.Y., has been appointed associate professor at Michigan State University. He will teach science writing in the School of Journalism and will also conduct radio and television programs on science over the university's stations.

F. E. TERMAN, dean of the School of Engineering and provost of Stanford University, has received the first Member-for-Life medal of the American Institute of Electrical Engineers. The medal will be awarded annually to an engineering educator.

ROBERT W. KRAUS, associate professor of botany at the University of Maryland, received the Darbaker prize of the Botanical Society of America during its recent annual meeting. He was honored for meritorious research in the field of microscopic algae.

As part of the celebration of the 50th anniversary of the founding of the society, 50 certificates of merit were awarded to distinguished plant scientists. The list included the current president of the AAAS, PAUL B. SEARS, and three former presidents—G. W. BEADLE, E. W SINNOTT, and E. C. STAKMAN.

BEN R. BURMESTER of the Regional Poultry Research Laboratory, USDA, East Lansing, Mich., has received the 1956 Tom Newman memorial award of the Poultry Association of Great Britain for his series of seven papers on visceral lymphomatosis of chickens.

ROGER MOE, formerly a member of the technical staff at the Bell Telephone Laboratories in Murray Hill, N.J., has been appointed senior scientist at the Palo Alto, Calif., laboratories of the Lockheed Missile Systems Division.

B. R. SEN of India, ambassador to the United States in 1951–52, has been appointed director-general of the Food and Agriculture Organization.

## Recent Deaths

LEROY ABRAMS, Stanford, Calif.; 81; emeritus professor of botany and former director of the Natural History Museum at Stanford University; 15 Aug.

ARTHUR L. CLARK, Kingston, Canada; 83; former dean of science at Queen's University; 19 Sept.

ALLAN R. CULLIMORE, South Orange, N.J.; 72; president emeritus of the Newark College of Engineering; 20 Sept.

RAMON DE LARA, Caracas, Venezuela; 72; former rector and professor of medicine at the University of Santo Domingo; 20 Sept.

FREDERICK G. ELSTON, New York, N.Y.; 61; mathematics instructor at Seton Hall University, 21 Sept.

HERBERT W. HARMON, Grove City, Pa.; 84; retired head of the physics department at Grove City College; 22 Sept.

GEORGE B. LAMB, Houston, Tex.; 60; director of Gulf Oil Corporation's exploration operation in the southern states; 20 Sept.

FRED G. LAPIANA, Eastham, Mass.; 71; retired textile chemist; 20 Sept.

FREDERICK SODDY, Brighton, England; 79; Nobel laureate in chemistry; 21 Sept.

WILFRED H. WRIGHT, Ottawa, Canada; 71; retired chief of laboratory services in the Federal Agriculture Department's plant products division; 22 Sept.

## Education

■ The American Board of Nutrition will hold the next examinations for certification as a specialist in human nutrition in April 1957 at Chicago, Ill. Candidates who wish to be considered for these examinations should submit applications *not later than 1 Mar.* Information may be obtained from the secretary, Otto A. Bessey, Environmental Protection Research Division, Quartermaster Research and Development Center, Natick, Mass.

■ John G. Fowlkes of the University of Wisconsin School of Education, who has spent most of the past 2 years in India advising the Ministry of Education, will direct the Wisconsin training program to improve science teaching in the secondary schools and teaching colleges of India. The work has been made possible by the university's recent acceptance of $84,800 from the Ford Foundation. The grant

will establish 20 fellowships for Indian educators in the School of Education. Fowlkes is being assisted by Milton Pella in preparing the program.

The fellowship recipients will arrive in January to spend 9 months studying science teaching methods at the university, at state colleges, and in high schools throughout the state. Their training will include actual teaching assignments in high schools. Emphasis in the program will be on general science, so that general science courses may be added to the curricula of Indian high schools.

■ A technical education team from Wayne State University is leaving for Thailand this month to assist in the development of the Bangkok Technical Institute. The nine members have signed 2-year contracts for an International Cooperation Administration mission that is expected to continue for from 3 to 6 years. Specialties represented by the group are teacher education, home economics, commerce, metal technology, woodworking and building trades, electronics, automotive trades, and diesel mechanics. Members of the Bangkok team have been teaching in Ohio, Alabama, Virginia, West Virginia, and Michigan. All have done undergraduate or graduate work at Wayne.

William E. Stirton, formerly a Wayne vice president, now with the University of Michigan, went to Thailand last spring and worked out the details of the project with the Thai government. Through a special agreement, Stirton remains official administrator of the $835,000 program. The Bangkok Technical Institute is expected to be a model for southeast Asia. It produces teachers for other technical institutes throughout Thailand.

Also under the ICA contract, Wayne State will enroll 30 Thai industrial educators during the initial 3-year period. These technical institute instructors will study American methods, both technical and professional.

■ Construction has begun on the University of Connecticut's new science building, which will cost $1.2 million. The building will be given over to the physics and chemistry departments, reflecting the tremendous development of these two university programs.

■ The teaching of writing, speaking, and engineering judgment should get more emphasis in chemical engineering courses, a survey of recent graduates by the Esso Research and Engineering Company indicates. A report on the study, which covers 125 employees graduated since 1949 from 51 schools, was presented recently by John W. Packie and Charles W. Smith during a session of the 130th national meeting of the American Chemical Society. Forty-five percent of the supervisors questioned listed inadequacy in letter and report writing as the greatest weakness among employees during the past 5 years.

## Grants, Fellowships, and Awards

■ The allocation of 12 grants for research on various phases of air pollution have been announced by the Public Health Service. Six of the grants, totaling $177,548, are for new projects. The remaining six grants, amounting to $141,020, will continue support of projects that are already under way.

These grants make a total of 32 that have been awarded since July 1955, when air-pollution research was made a responsibility of the Public Health Service. All told, $780,137 has now been allocated to agencies, institutions, and individuals outside the Federal Government for such investigations.

■ The John Hay Whitney Foundation has announced its Opportunity Fellowships Program. Its purpose is to broaden opportunities in America and, specifically, to give opportunity for special experience or advanced study to persons of exceptional promise who otherwise might not be able to reach their fullest development or make their fullest contribution.

The competition for opportunity fellowships is open to any citizen of the United States (including residents of territories) who has given evidence of special ability and who has not had full opportunity to develop his talents because of arbitrary barriers, such as racial or cultural background or region of residence. Awards have been made principally to the following groups: Negroes, Spanish-Americans, Chinese- and Japanese-Americans, American Indians, and residents of the Virgin Islands, Puerto Rico, Hawaii, Guam, Alaska, Samoa, and the Appalachian Mountain area.

Candidates are expected to be mature enough to have given positive evidence of exceptional promise, yet young enough to have their careers before them; in general, they should be between the ages of 22 and 35 and have completed their general undergraduate education. Candidates under 35 are given decided preference.

The fellowships are open not only for academic study (graduate) but for any kind of training or experience (journalism, industry, labor, the arts, and so forth) which may be most useful in developing varied talents and varied forms of leadership. Applicants for apprenticeships in such areas as agriculture, industry, and labor will be welcomed.

Awards are expected ordinarily to range from $1000 to $3000 depending on the nature of the proposed project and the financial need of the candidate. It is hoped that in many cases funds from other sources may supplement the awards.

Awards are made annually by a special committee on the basis of formal written applications by the candidates on forms provided by the foundation. Completed applications must be filed *not later than 30 Nov.* For further information, write to: Opportunity Fellowships, John Hay Whitney Foundation, 630 5th Ave., New York 20, N.Y.

■ Longwood Gardens of the Longwood Foundation, Inc., has announced a grant to the Department of Agriculture's Plant Introduction Section in Beltsville, Md., to support the exploration and introduction of new or little known plants of potential value to ornamental horticulture in the United States. The introduction of agricultural plants has long been the primary objective of this country's foreign plant exploration. The Longwood grant will now permit full-time search for ornamentals. Under the cooperative agreement recently consummated, the USDA will undertake exploration for ornamental plants in Japan, Yokushima, and the Ryukyu Islands during 1956 and 1957.

■ Grants from the Rumford Fund of the American Academy of Arts and Sciences are made in support of research in the areas of heat and light, including thermodynamics and radiation of any frequency, in amounts usually not exceeding $1000. Applications for grants should be filed *by 1 Jan. 1957* on forms available from the Chairman, Rumford Fund, American Academy of Arts and Sciences, 77 Massachusetts Ave., Cambridge 39, Mass.

■ The U.S. Atomic Energy Commission has announced the award of 48 unclassified life-science research contracts in medicine, biology, biophysics, radiation instrumentation, and special training. Twenty-one of the 1-year awards are new projects; five are in the field of medicine, 12 in biology, one in biophysics, and three in special training. Twenty-seven of the awards are contract renewals; 14 of these are in the medical sciences, ten in biology, two in biophysics, and one in radiation instrumentation.

■ The Scholar in Medical Science program to aid young men and women planning careers in academic medicine has been conducted since 1948 by the John and Mary R. Markle Foundation, in cooperation with approved medical schools in the United States and Canada. The general qualifications for candidates for the scholar grants are (i) nomination by an approved undergraduate medical

school; (ii) full-time faculty appointment to a medical school staff; (iii) fellowship training, already completed, in an area of science that is related to medicine; and (iv) a major interest in the teaching of medical students or in research in any science basic to medicine, or both, rather than in the private care of patients.

Candidates trained at any institution and holding any degrees acceptable for faculty rank in the nominating medical school are eligible. Each school is invited to submit the name of one candidate. For every scholar finally selected, the foundation will set aside $30,000, to be used over a 5-year period toward his support or his research or both. The grant will be paid to the cooperating medical school at the rate of $6000 annually, and in most cases will be supplemented by the school from its own budget or from other sources.

The number of scholars appointed annually has varied from 13 to 25. It is not likely to exceed the latter figure in any year. The directors of the foundation, in making the final selection, consider three factors: (i) the competence and promise of the candidate in medical research or teaching, as indicated by the medical school making the nomination; (ii) evidences of an environment conducive to well-rounded professional development, as stated in plans for the scholar by the medical school; and (iii) certain intangible qualities of the candidate indicative of the true scholar and leader.

Advance notice in the autumn as to whether a school intends to make a nomination will be appreciated. Nominations should be submitted by *1 Dec.* to the John and Mary R. Markle Foundation, 511 5th Ave., New York 17, N.Y.

## In the Laboratories

■ Fifty years of industrial alcohol and chemical production is being celebrated on 17 Oct. by U.S. Industrial Chemicals Company, division of National Distillers Products Corporation, New York. The company's history closely parallels industrial chemical growth in the United States.

Today U.S.I. manufactures a wide range of products, including polyethylene resins, metallic sodium, alcohols, esters, ethers, ketones, agricultural chemicals, animal feed products, intermediates, and fine chemicals—with production of zirconium, titanium, phosphoric acid, and isosebacic acid scheduled for the near future. But at its founding on 17 Oct. 1906 the company planned only for production of alcohol to serve industrial users under the Tax Free and Denatured Alcohol Act of that year.

■ The U.S. Atomic Energy Commission has available a limited supply of spent fuel elements from its materials testing reactor for rental to licensees as sources of gamma radiation. A flat charge of $100 per year, or fraction of a year, will be made for the use of each fuel element. The user will also pay handling and transportation costs.

The materials testing reactor is located at the National Reactor Testing Station near Idaho Falls, Idaho. Because the supply of irradiated fuel elements from the reactor is limited, they are available primarily for research and development purposes, and generally no one user may possess more than four elements at any one time.

■ Hughes Aircraft Company of Culver City, Calif., has announced that it is awarding 200 fellowships to M.S. degree candidates in engineering and physics so that they may continue their education while employed part-time at Hughes. Fellowship recipients will take advanced courses at the University of Southern California, the University of California at Los Angeles, California Institute of Technology, or at Stanford, Purdue, or West Virginia universities. The students, as members of the technical staff of the Hughes laboratories, will be considered professional engineers and scientists and will receive salaries as well as payment for tuition, books, and fees.

■ The Atomic Energy Commission has received 11 proposals from industrial firms to participate in the design, development, and construction of a food irradiation reactor for the Army Ionizing Radiation Center. The firms that made proposals follow: ACF Industries, Inc., Washington, D.C.; AMF Atomics, Inc., New York, N.Y.; Atomics International, Conoga Park, Calif.; Bell Aircraft Corporation, Buffalo, N.Y.; Blaw-Knox Company, Pittsburgh, Pa.; Burns and Roe, Inc., New York, N.Y.; Ebasco Engineering Company, New York, N.Y.; H. K. Ferguson Company, Cleveland, Ohio; Goodyear Tire and Rubber Company, Akron, Ohio; Kaiser Engineers, Oakland, Calif.; and Rust Engineering Company, Pittsburgh, Pa. A preliminary design concept is being completed for the AEC by the Internuclear Company of Clayton, Mo. A site for the center has not yet been selected.

■ A large industrial science center will be opened this month on a 15-acre tract in Morton Grove, Ill., by the Cook Electric Company. The new Cook Technological Center will be operated by more than 1000 scientists, engineers, technicians, and other staff members working in seven single-story buildings.

Cook divisions include: Cook Research Laboratories (basic and applied research in nuclear physics, servomechanisms, weather reconnaissance, radar, sonar, rockets, guided missiles); Inland Testing Laboratories (testing of components for the company, other manufacturers, and the Defense Department); Electronic Systems (engineering and production design of components and test equipment for military aircraft and guided missiles); Diaphlex (aircraft components manufacture); MagniLastic (stainless steel and alloy specialties manufacture); Wirecom (wire communications equipment manufacture); and Air-Mod Corporation, Vandalia, Ohio, wholly-owned subsidiary (aircraft modernization and modification). Initial occupancy of the new center is being made by advance teams from the Cook Research Laboratories and Inland Testing Laboratories.

## Miscellaneous

■ Results of a 5-year study of the metallurgy of molybdenum are summarized, evaluated, and interpreted in a research report for the Navy that has just been made available to industry through the Office of Technical Services, U.S. Department of Commerce. The work was conducted by Battelle Memorial Institute between 1949 and 1954. The final report, which was written by S. L. Case, contains an appraisal of the entire accumulation of data and their significance as applied to the three major phases of the investigation. *A Metallurgical Study of Molybdenum* may be obtained for $2.75 from OTS, U.S. Department of Commerce, Washington 25, D.C.

■ *Results of 1955 Fungicide Tests,* reprinted from a series of articles that appeared in *Agricultural Chemicals,* April through June, may be purchased in bound and covered form for $1 per copy by sending orders with remittance to Dr. A. G. Newhall, Department of Plant Pathology, College of Agriculture, Cornell University, Ithaca, N.Y. The publication of these results is under the sponsorship of the American Phytopathological Society. The new pamphlet is a continuation of the publication of results formerly provided through a supplement of the *Plant Disease Reporter,* Plant Disease Epidemics and Identification Section, U.S. Department of Agriculture.

The Temporary Advisory Committee on Collecting and Disseminating Data on New Fungicide Tests of the American Phytopathological Society has arranged for the publication of recent data and the continuation of a program for annual publications of fungicide test results in the future. Newhall is in charge of this project for the current year.

# Reports

## Intermittent Conditioned Reinforcement in Chimpanzees

If the delivery of food is correlated with a skeletal response made by a hungry organism (for example, pressing a lever), there will be a subsequent increase in the frequency of the response. We refer to the delivery of the food as reinforcement. The frequency of the response can also be increased if delivery of an object that is exchangeable for food (for example, a coin) is correlated with the response. We refer to the delivery of such an object as conditioned reinforcement.

The study of reinforcement has shown that highly stable patterns of responding can be developed when food is delivered according to a schedule (*1*). Under the 5-minute fixed-interval schedule, reinforcement is correlated with the first response, which occurs after a 5-minute interval has elapsed. Each successive interval is timed from the reinforcement that terminates the preceding one. The behavior associated with this schedule is characterized by a pause at the start of each interval followed by a positively accelerated rate of responding to the point of reinforcement (*1*). Under the 20-response fixed-ratio schedule, the reinforcement is correlated with every 20th response. The behavior associated with this schedule is characterized by high, stable rates of responding (*1*). The present paper describes a method that utilizes these schedules for the study of conditioned reinforcement (*2*).

The subjects were two male chimpanzees maintained at 80 to 85 percent of their normal body weight. Initially, they received food every time they pressed a lever. After 20 reinforcements, they were shifted to a 5-minute fixed-interval schedule and remained on this schedule for 180 hours. An overhead light indicated that the lever was connected, and the animals pressed the lever only when this light was on. In the next phase of training, each subject was given plastic poker chips at the start of each session and was trained to obtain food by inserting the poker chips through a slot in a Plexiglas window. One-minute periods in which the window was illuminated by a red light alternated with 2-minute periods of no illumination, but the overhead light remained off. The subjects soon learned that insertion of a poker chip yielded a piece of food only when the red light was on. Each animal received more than 500 reinforcements during this training. In the final phase, the overhead light was on, and pressing the lever resulted in the scheduled delivery of poker chips—that is, conditioned reinforcement. The procedures were programmed, and the results were recorded automatically by relay switching circuits, timers, electromagnetic counters, and a cumulative-response recorder.

The first schedule of conditioned reinforcement was a 5-minute fixed interval. At the end of each hour, the red light came on for 10 minutes, and the animal could exchange for food the poker chips it had obtained during the hour. The first cumulative response record in Fig. 1 shows the third hour on this schedule for one subject. The rates of responding were low, and further investigation revealed that behavior could not be sustained on this schedule unless poker chips could be exchanged for food more frequently (*3*).

The next procedure combined both interval and ratio schedules in a multiple schedule (*1*) as follows. An orange or green light above the lever indicated whether the 5-minute fixed interval or the 20-response fixed ratio, respectively, was in effect. The two conditions were programmed randomly with the restriction that the same one could not occur more than three times in succession. The frequency with which poker chips could be exchanged for food had little effect on the behavior that developed under this schedule (*3*). The second and third records in Fig. 1 present the last 2 hours of a session in which the animal had to obtain 60 poker chips before it could exchange them for food. The two distinct patterns of responding that can be identified indicate that the behavior came under the control of the orange and green stimuli. The fixed-ratio segments include few pauses and are characterized by rates of responding that exceed one response per second. The fixed-interval segments are characterized by low rates of responding and sometimes include only one response; however, high rates occasionally occurred in intervals after 40 poker chips had been delivered (Fig. 1*A* and *B*). Observation of the animals revealed that such bursts of responding were usually accompanied by general activity and loud vocalizations. This suggests that the imminence of the exchange of poker chips for food had an emotional effect that momentarily attenuated the stimulus control.

The third schedule of conditioned reinforcement was the 20-response fixed ratio alone. The fourth record in Fig. 1 presents the first session on this schedule after 120 hours on the multiple schedule. Although there were long pauses in the middle of the session, all responding occurred at the characteristic ratio rate. The almost continuous responding near the end of the session included 960 responses that were emitted in 6 minutes. In subsequent sessions, the pauses dropped out and the 60 poker chips were usually obtained within 15 minutes.

The importance of conditioned rein-

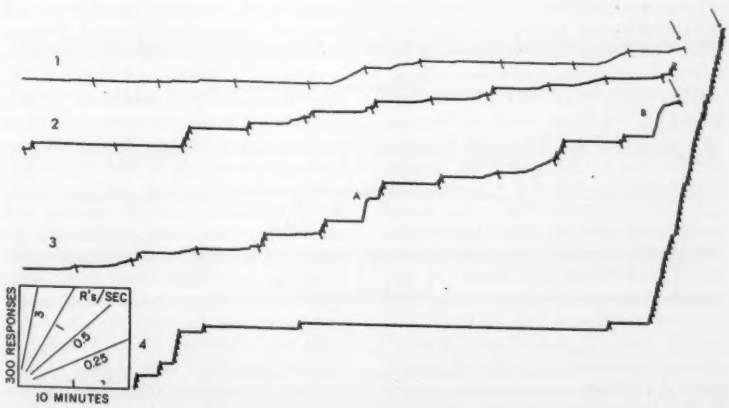



Fig. 1. Representative cumulative response curves for chimpanzee 119 showing three schedules of conditioned reinforcement. The vertical pips indicate delivery of poker chips, and the arrows indicate exchanges of poker chips for food.

forcement (for example, money) in developing and maintaining human behavior is apparent. However, the rapid attenuation of the effectiveness of conditioned reinforcement when food delivery is delayed is a serious difficulty in most experimental studies (*4*). The method employed in the present study should make it possible to investigate many behavioral processes independently of the effects of food ingestion during a session. For example, the effect of varying the amount of conditioned reinforcement by delivering one or more poker chips per reinforcement could be investigated. Also, one could assess the effects of "inflating" this coin of the realm by requiring the subject to insert more than one poker chip to obtain one piece of food. The significance of such variables will have to be determined by further research.

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**References and Notes**

1. C. B. Ferster and B. F. Skinner, *Schedules of Reinforcement* (Appleton-Century-Crofts, New York, in press); B. F. Skinner, *Am. Psychol.* 8, 69 (1953).
2. This investigation was supported in part by research grant M-1005 from the Institute of Mental Health of the National Institutes of Health, U.S. Public Health Service, and in part by the National Science Foundation.
3. Two manuscripts presenting in detail the effects of delays in exchanging poker chips for food are in preparation.
4. For example, I. F. Saltzman, *J. Comp. and Physiol. Psychol.* 42, 161 (1949); J. F. Hall, *ibid.* 44, 246 (1951).

22 August 1956

## Generality of Some Academic Reputations

College students often state their beliefs that some courses, fields of study, and professors, are "hard" or "easy." Descriptions of professors occasionally include references to their competence. There is little objective evidence that students on a single campus agree with one another to any statistically reliable extent regarding "hard" or "easy" courses, majors, or professors. When the Selective Service System authorized the nationwide administration of a scholastic aptitude test to help determine who should be deferred from the draft, 339,000 college students were tested in 1951. Chauncey (*1*) and Wolfle and Oxtoby (*2*) present data that compare test results from students in different areas of study. The present study (*3*) was conducted to (i) measure the extent to which college students at a western state university agreed in their recognition of "hard" and "easy" reputations supposedly acquired by different courses, majors, and professors, (ii) compare rankings of fields of study by reputation for difficulty with the Wolfle-Oxtoby rankings of students majoring in different fields, and (iii) compare the reputation rankings with grades given during one quarter by professors in the various departments at this same school.

The student population was stratified for class (freshman, sophomore, and so forth) and sex, and a random sample was drawn. Each subject was contacted by telephone, told how he had been selected to participate in a research study, told that the nature of the study could not be discussed with him until all respondents were assembled at one place and time, and asked to be at the Student Union Auditorium at a specific time.

Of 236 students contacted, 90 participated in the study. When the participating sample is compared with the total population with respect to the stratification variables utilized, the lowest probability ($p$) that the deviations of sample statistics from population parameters could occur by chance alone is approximately 0.3. This $p$ value refers to the representativeness of the sample of graduate students participating in the study. The remaining $p$ values range from 0.6 to 0.9. Therefore, the null hypothesis—that the deviations are not significant—is accepted.

The 90 subjects were simultaneously presented with a questionnaire that explained the nature of the study and stressed the subjects' anonymity. The questionnaire also cautioned against answering the questions on the basis of personal experience with various courses, professors, or majors and requested responses on the basis of the reputation that each participant thought the course, major, or professor had acquired (*4*).

The questionnaire did not structure the breakdown of majors, and the respondents tended to follow the breakdown employed by the university. To facilitate comparisons between these data and those of Wolfle and Oxtoby, I grouped the reputation data into the categories employed by Wolfle and Oxtoby. The same groupings were employed in comparing mean grade points per credit given in the autumn quarter of 1950–51 by professors in these various fields at the university where this study was conducted. Some fields—for example, nursing and engineering—were not represented on this campus. Therefore, the only field groupings compared were those that were common to the Wolfle-Oxtoby breakdown and the university where this study was conducted. Table 1 compares the different fields with respect to how students majoring in them on a nationwide basis performed on the Selective Service College Qualification Test (SSCQT), the reputation these fields have for difficulty on the campus studied, and their actual difficulty on the campus studied as measured by mean grade points per credit given 3 years earlier by the professors in the different departments. Kendall's tau coefficient, a rank-order test of relationships, seemed to be appropriate for correlating these three rankings. The correlation between the SSCQT rankings and the reputation for difficulty rankings is + .61, and the correlation between the local reputation for difficulty and the actual difficulty, locally, of these fields of study, is only + .39. In addition to the obvious possibility that the difference between the + .61 and + .39 correlations is a function of chance, there are several interesting explanations of this finding, and they are not mutually exclusive.

Common sense might dictate that local reputations for difficulty should correlate more highly with local grading. That both correlate more highly with the SSCQT results than with each other suggests that the reputation results obtained locally are to some degree representative of reputations (attitudes) attributed nationally. It also suggests that professors have a perception of themselves as representatives of their fields of specialty that is fairly congruent with the more widespread attitudes mentioned. Thus, it appears that the formation of these academic attitudes resembles the formation of other types of attitudes—for example, toward minority groups. That is, they derive from contact with the attitude more than from contact with the referent of the attitude. Wolfle and Oxtoby comment, "In conclusion, those fields which have reputations of requiring abstract and rigorous thinking (*e.g.*, physics, chemistry, law) attract

Table 1. Rankings of fields of study by SSCQT performance, reputation for difficulty, and strictness of grading on one campus.*

| Fields of study | Rank of average AB (SSCQT) (*2*) | Rank of reputation by difficulty (local) | Rank by strictness of grading (local) |
|---|---|---|---|
| Physical sciences | 1 | 2 | 1 |
| Chemistry | 2 | 1 | 2 |
| English | 3.5 | 4 | 3 |
| Psychology | 3.5 | 5 | 5 |
| Fine arts | 5 | 3 | 9 |
| Business and commerce | 6 | 9 | 4 |
| Education | 7 | 7 | 8 |
| Home economics | 8 | 6 | 6 |
| Physical education | 9 | 8 | 7 |

* Kendall's tau (SSCQT versus reputation), + .61; Kendall's tau (SSCQT versus grades), + .61; Kendall's tau (reputation versus grades), + .39.

students who are, on the average, superior to those who major in traditionally "easier" subjects (*e.g.*, business and commerce or education)" (*2*). The results presented here lend credence to the implication of Wolfle and Oxtoby that fields of study enjoy differential reputations that are generalized beyond the individual campus.

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### References and Notes

1. H. Chauncey, *Science* **116**, 73 (1952).
2. D. Wolfle and T. Oxtoby, *Science* **116**, 311 (1952).
3. Sarah Gertrude Malone contributed significantly to this study. She administered the questionnaire, took responsibility for contacting the subjects, and coded some of the data in order that I would not learn the reputations of my colleagues.
4. Only one respondent claimed to be ignorant of the reputations in question. Fifty-seven percent admitted that they had been influenced by reputations in selecting their courses at least as often as one course per year. Approximately 7 percent of the teaching staff had reputations pertaining to difficulty and/or competence. These results do not indicate a relationship between competence and difficulty reputations.

2 August 1956

## Blocking Effect of Ethyl Alcohol on Inhibitory Synapses in the Eye of Limulus

The lateral eyes of the horseshoe crab, *Limulus polyphemus*, appear to have a synaptic system in which only inhibitory effects are produced. Hartline (*1*) has found that the discharge of impulses from single receptor units in these eyes can be inhibited by shining light upon adjacent units. He and his coworkers have studied the inhibitory effect under a variety of experimental conditions and have found that the changes in frequency of the inhibited unit obey quantitatively simple relations to the areas, intensities, and positions of the spots of light that activate the inhibiting units (*2*).

Several years ago Ragnar Granit suggested to one of us (E.F.M.) that the inhibitory synapses might be blocked selectively by ethyl alcohol, since this substance appeared to block inhibition in the vertebrate eye: Bernhard and Skoglund (*3*) had found that both the "off" response and the PIII process, which is supposed to be associated with inhibition, were abolished by this alcohol.

The experiment was tried, and ethyl alcohol was indeed found to abolish the inhibitory effect reversibly (*4*). In fact, after the application of alcohol, the frequency of discharge was actually increased when the eye was illuminated in a manner that formerly caused inhibition. The increase in frequency was suspected to be due to the effects of scattered light rather than to a reversal of inhibition. These results were not published because neither a method of controlling scattered light nor facilities for making good oscillographic recordings was then available.

We have recently repeated the experiment a number of times and confirmed the earlier results under more suitable conditions (*5*). The excised eye was mounted vertically in a moist chamber, and the chitin and connective tissue were removed from the back to permit easy penetration of the bathing fluid into the nervous structures. The cornea was covered with a mixture of paraffin and lamp black to eliminate scattered light (the wax was pierced by small holes to permit light to fall on the desired areas) (*6*). The optic nerve was combed into bundles until one was found which showed unitary activity. Wick electrodes inserted into chlorided silver tubes were used for recording. Artificial sea water with or without alcohol was caused to flow down the back surface of the eye at a rate of about 1 $cm^3$/min throughout the experiment. Two sources of light of constant intensity and controllable duration were used to focus small spots of light on the excitatory and inhibitory regions. Electronic timers were used to time the illumination according to a fixed program repeated every 10 sec throughout each experiment. During each interval the excitatory illumination was turned on for 6 sec. The inhibitory illumination was turned on for about 1½ sec after a delay of 1½ sec from the start of the excitatory illumination.

Sets of three oscillographic records were taken at appropriate intervals. In the first record in each set, both the excitatory and the inhibitory illuminations were presented. In the second record, only the excitatory illumination was presented. The difference between the number of impulses discharged during the final second of inhibition and the number discharged in the same interval of the control record provided an index of the degree of inhibition. A third record in which the inhibitory illumination alone was presented served to indicate whether sufficient light was scattered into the excitatory area to cause the discharge of impulses. The results of experiments in which such an effect developed were discarded.

A typical experiment is shown in Fig. 1. The top record shows that a strong inhibitory effect was present after the preparation was equilibrated in artificial sea water. Four percent by volume of 95-percent ethyl alcohol was then added to the bathing fluid, and records were taken as the effect of the alcohol developed (second record) and after it had exerted its full effect (third record). It is evident that the inhibitory effect was almost completely abolished. Alcohol-free bathing solution was next applied, and records were taken during partial recovery (fourth record) and after complete recovery (fifth record). The inhibi-

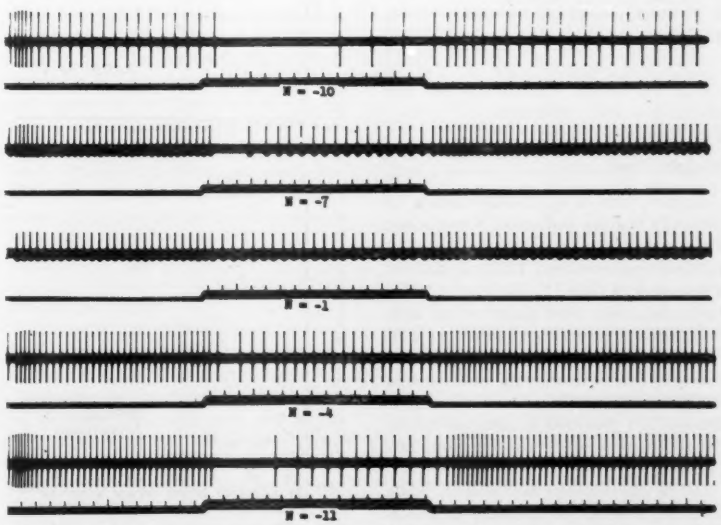


Fig. 1. Disinhibitory effect of 4-percent ethanol. Top record taken 1 min before application of alcohol; second and third records, 18 and 50 min after application. Fourth and fifth records taken 26 and 100 min after return to alcohol-free solution. $N$ = inhibited frequency minus uninhibited frequency during last second of inhibitory illumination. Time marks in tenths of a second. Elevation of time trace indicates duration of inhibitory illumination. Time constant of amplifier, 0.01 sec. The decrease in spike height during application of alcohol is regularly observed and is presumed to be due to the effect of the alcohol vapor on the portion of the nerve bundle between the recording electrodes.

tory effect caused a deficit of 10 impulses before the application of alcohol; of 1 impulse when the alcohol had exerted its effect; and of 11 impulses after recovery. The initial frequency in the last record was higher than in the first, presumably owing to further dark adaptation during the experiment, yet the number of impulses lost during inhibition was approximately the same. This is in accordance with Hartline's finding (*2*) that the number of impulses lost during inhibition is independent of the initial frequency over a wide range.

A single preliminary experiment has been made to determine whether three other substances have a selective effect on inhibition. Acetyl choline (100 mg/100 $cm^3$) and curare (5 mg/100 $cm^3$) had no effect whatever. Nicotine (0.16 percent) caused spontaneous activity and then blocked conduction in the nerve fibers but had no selective effect on inhibition.

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**References and Notes**

1. H. K. Hartline, *Federation Proc.* 8, 69 (1949) (abstr.).
2. ———, H. G. Wagner, F. Ratliff, *J. Gen. Physiol.* 39, 651 (1956).
3. C. G. Bernhard and C. R. Skoglund, *Acta Physiol. Scand.* 2, 10 (1941).
4. E. F. MacNichol, Jr., Ph.D. dissertation, Johns Hopkins University (1952), unpublished, Appendix A.
5. This work was supported by a grant from the National Science Foundation.
6. F. Ratliff, personal communication.

9 July 1956

## Fat Changes during Weight Loss

In the course of nutritional studies, 13 clinically healthy and active young white males were placed upon a low-calory diet yielding approximately 1000 cal/day for a period of 24 days (*1*). Soft-tissue teleoroentgenograms were taken at six anatomical sites during the preliminary control period and again at the end of the period of caloric restriction. These x-rays, made and measured under standard conditions (*2*), provided an accurate measure of changes in the subcutaneous fat-plus-skin layer on nine parts of the body.

All of the subjects lost weight, while incurring a deficit of the order of 40,000 cal: the median weight loss was 8.3 kg, or 12 percent of the original value. Subcutaneous fat decreased with median losses of 4 to 5 mm for "central" fat (deltoid pocket, iliac, and trochanteric) and 1 to 2 mm for "peripheral" (lower arm and lower leg), as is shown in Table 1. Decreases in subcutaneous fat ranged from 16 percent to 47 percent of the initial values. The rate of fat lost per kilogram of weight loss ranged from 0.1 to 0.6 mm, depending on the part considered.

Table 1. Median values for subcutaneous fat and weight before and after weight reduction and changes in fat per kilogram of weight loss.

| Measurement (thickness in mm) | Median (before) | Median (after) | Decrease (median) | Decrease (per kg) |
|---|---|---|---|---|
| Weight (kg) | 69.1 | 60.7 | 8.3 | |
| Lateral arm fat | 4.4 | 3.4 | 1.0 | 0.1 |
| Medial arm fat | 3.8 | 2.7 | 0.7 | 0.1 |
| Deltoid "pocket" fat | 12.5 | 7.7 | 4.4 | 0.5 |
| Iliac fat | 12.2 | 7.1 | 5.7 | 0.7 |
| Trochanteric fat | 13.6 | 9.5 | 5.9 | 0.6 |
| Lateral leg fat | 5.6 | 4.7 | 0.9 | 0.1 |
| Anterior leg fat | 3.0 | 2.7 | 1.1 | 0.2 |
| Medial leg fat | 7.6 | 5.7 | 2.3 | 0.3 |
| Posterior leg fat | 5.9 | 4.3 | 1.5 | 0.2 |

Losses in subcutaneous fat were clearly related to the initial thicknesses. Those parts of the body with the thickest fat deposits sustained the greatest loss during caloric restriction (Fig. 1, top). In like fashion, those *individuals* with greater amounts of fat to start with sustained greater losses in fat (Fig. 1, bottom). Rank-order correlations in each case were found to be highly significant, an exact test for significance (*3*) being used.

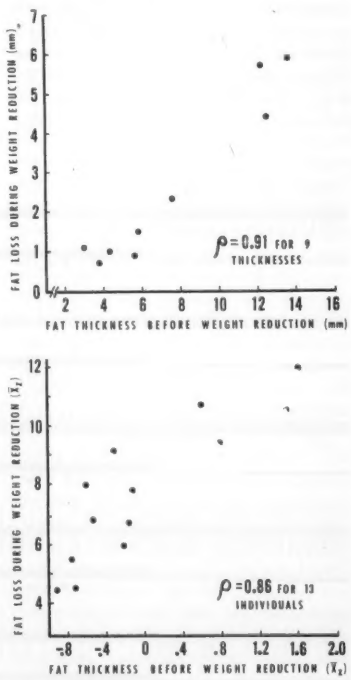


Fig. 1. Relationship between initial subcutaneous fat thicknesses and amount of subcutaneous fat lost after 24 days on a 1000-cal diet. (Top) Scattergram showing changes in the nine fat thicknesses measured in this study. (Bottom) Scattergram showing changes in 13 subjects. [Individual mean Z scores for fat are used as an indication of total fatness (*4*).]

Since fat is withdrawn in proportion to the initial amount of fat present, relative fat patterns before and after weight reduction tend to preserve their individual characteristics. This finding has been published elsewhere (*4*).

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**References and Notes**

1. This paper reports research undertaken in cooperation with the U.S. Quartermaster Food and Container Institute and has been assigned No. 543 in the series of papers approved for publication. The views or conclusions contained in this report are our own. They are not to be construed as necessarily reflecting the views or endorsement of the U. S. Department of Defense.
2. S. M. Garn and J. H. Saalberg, *Human Biol.* 25, 144 (1953); S. M. Garn, *ibid.* 26, 59 (1954).
3. E. G. Olds, *Ann Math. Statistics* 9, 133 (1938).
4. S. M. Garn, *Human Biol.* 27, 75 (1955) and *Ann. N.Y. Acad. Sci.* 63, 537 (1955).

10 August 1956

## Reaction of 8-Quinolinol with Cerium (III)

The reaction between cerium (III) and 8-quinolinol was first studied by Pirtea (*1*), who used it for the gravimetric determination of this ion. The unusual nature of this reaction was indicated when it was found that the formula of the precipitated chelate was $Ce(C_9H_6NO)_4 \cdot 2H_2O$, containing 18.73 percent cerium. The cerium had not been precipitated as the trivalent chelate, but an oxidation had occurred giving a chelate in which the cerium was present in an oxidation state of four. Although 8-quinolinol usually acts as a reducing agent, in this case it was the oxidizing agent.

Berg and Becker (*2*) found that the precipitation of cerium (III) by 8-quino-

linol from a tartrate-buffered solution gave the trivalent chelate corresponding to the formula $Ce(C_9H_6NO)_3$. Identical results were obtained using the method of homogeneous precipitation (*3*). In both of these cases the cerium was present in the trivalent state in the chelate.

Since there is a difference in color of the two chelates—the trivalent chelate is yellow, whereas the tetravalent chelate is purple—it was thought that a study of the absorption spectra of the chelates might be useful as an analytic method. A method may be developed for the determination of cerium in a mixture with other rare-earth metal ions, since the other rare-earth chelates with 8-quinolinol are all yellow in color (*3*). Also, a study of the absorption spectra might be helpful in the elucidation of the structure of the tetravalent chelate.

The absorption spectra of $Ce(C_9H_6NO)_4$ in $CHCl_3$ and 1*N* HCl and $Ce(C_9H_6NO)_3$ in 1*N* HCl are shown in Fig. 1. The curves were determined with a Beckman, model DU, spectrophotometer, using 1.00-cm silica cells. The chelates were prepared by methods already described (*1, 2*). The absorption spectra of the two chelates in 1*N* HCl are identical, giving maxima at 312 and 360 mμ. 8-Quinolinol also gives identical maxima in 1*N* HCl, which indicates that the two chelates are completely dissociated in this solvent. This is what would be expected from the ready solubility of the chelates in strong acid solution.

The spectrum of the cerium (IV) chelate in $CHCl_3$ exhibits three maxima in the wavelength region studied. Maxima were observed at 307, 370, and 480 mμ. Obviously, the 307- and 370-mμ maxima are those of 8-quinolinol, but the 480-mμ maximum is caused by the chelate itself. This would indicate that the tetravalent chelate could not be an addition product having the composition $Ce(C_9H_6NO)_3 \cdot C_9H_6NOH$. The trivalent chelate was too insoluble to be studied in $CHCl_3$.

The maximum at 480 mμ could thus be used for the qualitative or quantitative determination of cerium, either alone or in the presence of other rare-earth metal ions. Further studies are being conducted on this determination.

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**References**

1. T. I. Pirtea, *Bul. Chim. Soc. Române Chim.* 39, 83 (1937–38).
2. R. Berg and E. Becker, *Z. anal Chem.* 119, 1 (1940).
3. W. W. Wendlandt, *Anal. Chim. Acta* 15, 109 (1956).

13 August 1956

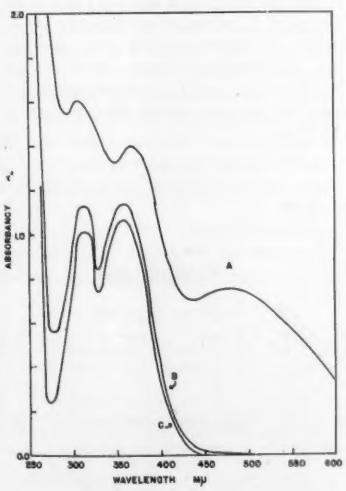


Fig. 1. The absorption spectra of the cerium 8-quinolinol chelates in various solvents. (*A*) $Ce(C_9H_6NO)_4$, $3.79 \times 10^{-4}M$ in $CHCl_3$; (*B*) $Ce(C_9H_6NO)_4$, $1.72 \times 10^{-4}M$ in 1*N* HCl; (C) $Ce(C_9H_6NO)_3$, $2.18 \times 10^{-4}M$ in 1*N* HCl.

## X-ray Microscopy of Thin Tissue Sections

The methods of projection x-ray microscopy have now been developed to the point where applications can be sought in a wide variety of problems. In the field of biology one of these is the examination of sections of tissue. Thus, it will be instructive to view relatively thick slices stereoscopically and also to compare the appearance of thin sections under the optical and x-ray microscopes. For such comparisons the sections must be no more than a few microns thick, as indeed they must be for all x-ray microscopy at high magnifications if confusion owing to overlying detail is to be avoided. To obtain the necessary image contrast with thin biological preparations, very soft x-rays must be employed.

The experiments described here were made with a projection x-ray microscope, as described by Nixon and Cosslett (*1*). Absorption in the several centimeters of air through which the rays pass in this apparatus must be eliminated if soft x-rays are to be used. This was done successfully by circulating helium through the enclosed specimen and photographic chamber. In our early trials, gold or nickel foils about 1 μ thick served as target windows for the x-ray tube operated at 3 to 6 kv. Under these conditions some image contrast was produced by thin specimens, but it was not adequate in photographs of sections of soft tissue. Far better results were obtained using

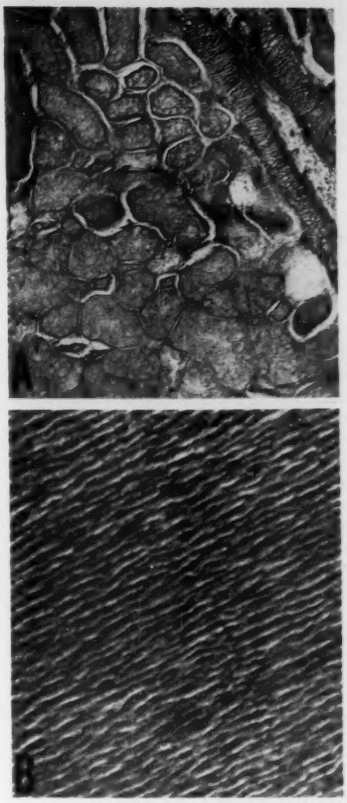

Fig. 1. (*A*) X-ray micrograph of a 10-μ section of frozen-dried mouse kidney. The paraffin-imbedded tissue was cut on a conventional rotary microtome. The section, mounted on a thin Formvar substrate, was deparaffinized before photography. (× 180) (*B*) X-ray micrograph of decalcified human dentin. A 5-μ section of the methacrylate-imbedded tissue was cut on a rotary microtome equipped with a glass knife, was mounted in Formvar, and the plastic was removed. (× 450).

aluminum as target window. Only a few percent of the K-radiation of aluminum, with a mean wavelength of 8 A, is absorbed in the helium, and very little white radiation of shorter wavelength is produced even when relatively high excitation voltages are applied to increase the efficiency of x-ray production. In this way very satisfactory photographs with exposure times of 5 to 10 minutes have been obtained by operating the tube at 10 to 15 kv, the target window being 7 μ of aluminum foil.

Figure 1 gives two examples of micrographs made under these conditions. The top picture (*A*) is of a 10-μ section through the cortex of frozen-dried mouse kidney at a magnification of about 180 times. The cells lining the convoluted tubules, which are the chief histological structures of this photograph, are discern-

ible, and much detail, including the musculature, is seen within the arteriole at the right. The bottom photograph (*B*) is of a 5-μ section through acid-decalcified dentin of a human tooth. The dentinal tubules that run lengthwise of the section are clearly visible at this magnification of 450 times, as are many small fibers associated with them.

There are still many evident improvements to be made in preparing sections for x-ray microscopy and in mounting them, which will certainly lead to corresponding improvements in the photographs obtained. Nevertheless, these examples demonstrate that microscopy with soft x-rays has already developed to the point where it can provide useful histological information.

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**Reference**

1. W. C. Nixon and V. E. Cosslett, *Brit. J. Radiol.* 28, 532 (1955).

20 August 1956

## Graft-Induced Transmission to Progeny of Cytoplasmic Male Sterility in Petunia

Many different manifestations have been revealed of hereditary properties of the cytoplasm. Thus, such different phenomena as maternal characters determined in the egg prior to fertilization, temporary environmentally induced, cytoplasmically determined characters, and interactions between nuclear genes and cytoplasmic factors have been demonstrated (*1*, *2*). In a few instances (*3*), hereditary elements in the cytoplasm seem to be independent of nuclear control; one of these is the cytoplasmic male sterility in *Petunia*—the subject of this report (*4*).

The main avenue of attack on the nature of cytoplasmic inheritance has been to transfer by breeding different genomes into different cytoplasms. Despite the advantages of this method in demonstrating the matroclinous products, it neither proves that the cytoplasm as a whole by itself (a genuine "plasmon") determines hereditary traits in the same sense as nuclear genes do, nor can it prove that certain loci ("plasmagenes") are responsible for hereditary properties. Goldschmidt (*2*), while reviewing the body of evidence, tends to reject the plasmagene concept as suggestive, unnecessary, and misleading and chooses to find alternative interpretations to the facts. With certain assumptions Michaelis (*5*) formulated an interesting statistical model for hereditary units in the cytoplasm. Although his assumptions are reasonable, they are arbitrary; and the method is useful only for characteristics that express themselves in measurable gradations. Only in the case of the killer effect in *Paramecium* (*6*) has a self-reproducing hereditary particle of the cytoplasm ("kappa") been demonstrated. The behavior and chemical nature of this particle does not reveal whether it is an intimate part of the cytoplasm or a self-reproducing foreign inclusion producing deleterious effects in certain genotypes. Significant gaps thus exist in our knowledge about hereditary elements of the cytoplasm.

This preliminary report deals with an attempt to obtain evidence on the nature of cytoplasmic male sterility in *Petunia* by means of grafting. The following lines were used (*7*): (i) Northern Star, a fertile variety having a lavender corolla with a large white central star, and (ii) P-431-54 (ms), a completely male-sterile line having a dark garnet corolla and violet throat color. Anthers of the latter are greatly reduced in size and are devoid of functional pollen.

Self- and sib-pollinations of the Northern Star for two generations yielded only fertile progeny. By crossing the male-sterile line with Northern Star and three other unrelated varieties for two generations, exclusively male-sterile progeny were obtained (Fig. 1). These results, which conform to the much wider experience of other workers, suggest that this sterility factor is independent of nuclear genes.

Reciprocal grafts between fertile and male-sterile lines were made in two separate series of experiments in 1954 and 1955. No changes were noticed in the fertility or sterility of the graft components, but observations were limited by the short survival of the scions. All scions of 15 combinations of male-sterile and fertile died shortly after producing a few flowers; consequently, seeds could not be obtained from pollinations with fertile pollen. Scions of the fertile variety grafted on male-sterile stocks survived slightly longer than the reciprocal grafts. Seed was produced from two scions in each of the two series, from both sib- and self-crosses (the latter with pollen from the same flower as well as that from flowers of the donor plant). The germination rate of the seed in petri dishes was approximately 45 percent. All the work was conducted in a greenhouse in complete isolation from other lines of *Petunia*.

Progenies were grown from seeds produced by the scions and were subjected to additional test crosses to test the inheritance of male sterility. The results of these tests are summarized diagrammatically in Fig. 1. Progeny of the fertile scions grafted on male sterile stocks consistently included both fertile and sterile plants, whether from self- or sib-crosses. The number of mature plants obtained was small because the seeds germinated poorly in soil and many seedlings died. In the first series from selfing the scions with pollen of the same flower, three fertile and three male-sterile plants were obtained. Two of the male-sterile plants recovered some fertility after the third or fourth flower, and only one plant remained entirely sterile for the 12 months of its life. Seeds obtained from scion flowers pollinated with pollen from the donor plant produced eight fertile and two male-sterile plants. In the second series, 11 plants of a total of 38 remained completely male-sterile. All plants in both series showed the characteristic flower color of the Northern Star and no resemblance to the color of the male-sterile line or that of the $F_1$'s.

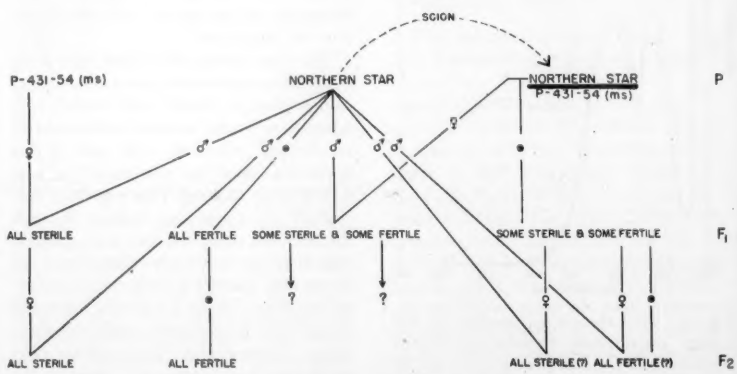


Fig. 1. Diagram of pedigrees. Graft combination indicated in upper right by fraction symbol, the scion being above, the stock below, the line.

Backcrosses between the first-generation male-sterile plants in the progeny of selfed scions and the Northern Star donor gave only male-sterile progeny, but the maximum number of plants tested per backcross was only 28. Only fertile progeny were secured from the selfs and backcrosses with the Northern Star donor of the fertile first-generation segregants in the progeny of selfed scions. Selfing the Northern Star donor likewise yielded only fertile progeny.

For several reasons these data do not permit extensive speculation about the nature of this cytoplasmic sterility. High heterozygosity of the material is likely because it is moderately self-incompatible. Large numbers of offspring of the $F_2$ are needed to establish independence of the cytoplasmic factor from nuclear genes. Low germination rates and high seedling mortality might have distorted segregation ratios. It would also be of interest to know whether longer lived scions would continue to maintain the same phenotype. The apparently autonomous behavior in the scions might be the result of a certain threshold requirement obscured by the short life of the scions. No explanation can be offered now for the better survival of fertile/male-sterile than reciprocal grafts. Experiments will be undertaken to study these and related problems.

Whatever doubts may be raised by these factors of uncertainty, the fact remains that the grafting induced changes in the fertile scion that resulted in the appearance of cytoplasmic sterility in its progeny. Although it seems most likely that this change was induced by movement of cytoplasmic sterility determinants from stock to scion, the tests do not entirely rule out other explanations. There is a remote possibility, for instance, that nutritional deficiency, which might have been induced by grafting, might cause a disturbance in cytoplasmic enzyme activity in such a way as to lead to an increase or decrease of sterility-determining entities of the cytoplasm.

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### References and Notes

1. E. Caspari, *Advances in Genet.* **2**, 1 (1948).
2. R. B. Goldschmidt, *Theoretical Genetics* (Univ. of California Press, Berkeley, 1955), pp. 193–244.
3. F. von Wettstein, *Biol. Zbl.* **65**, 149 (1946); P. Michaelis, *Advances in Genet.* **6**, 287 (1954).
4. I am indebted to C. M. Rick of the department of vegetable crops, University of California, Davis, for collecting some of the data and for giving helpful criticism and advice in carrying out the experiments and in writing the present report.
5. P. Michaelis, *Züchter* **25**, 209 (1955).
6. T. M. Sonneborn, *Advances in Genet.* **1**, 263 (1947).
7. The lines were kindly furnished by W. Atlee Burpee Co.

11 July 1956

## Bony Dimensions and the Estimation of Men's Reference Weight

"Standard" body weight has been defined as the average weight for height, age, and sex. Both the term and the definition are unsatisfactory. The adjective *standard* may readily suggest that the value found in a height-weight table is not only "desirable" but "optimal." For this reason, Pett, in presenting the results of the Canadian survey (*1*), speaks simply of average weights. Only detailed studies of morbidity and mortality can yield information on the biological significance of given degrees of overweight or underweight at a particular age (*2*).

Although stature is a relatively good predictor of total skeletal weight (*3*), it is not an adequate measure of the bony framework in the estimation of reference weights. First, ordinary height-weight standards do not take into account the individual differences in the relative contribution of the legs and the trunk (plus head) to stature. Second, and more important, the lateral dimensions of the skeleton are not considered.

The need for paying attention to characteristics of "body build" other than height has been recognized, but adequate data for adults are not available. The widely circulated tables of "ideal" (later, "desirable") weights for women and men, issued by the Metropolitan Life Insurance Company, give ranges of weight at a given height for individuals of small, medium, and large frame. Unfortunately, no definition of the frame size is provided (*4*).

In the present study, which was carried out on random samples of Minneapolis firemen ($N$, 238; mean age, 41.6 years), five bony dimensions were included: stature ($S$); cristal height, as a measure of "leg length" ($L$); bicristal ($C$) and biacromial ($A$) diameters, as measures of linearity-laterality of the frame; and the biepicondylar diameter of the humerus ($H$). The width of the limb bones is of interest as a pure skeletal measure. The lateral size of the bony frame of the trunk is of consequence primarily because of the associated variation in the size of the skeletal musculature and viscera, not because of the direct contribution of the pelvic and shoulder girdles to body weight.

An equation, of the type $\hat{Y} = a + b_1X_1 + b_2X_2 + \cdots b_nX_n$, for predicting body weight ($W$) from the five bony dimensions and age ($E$) is given in Table 1. The multiple $R = 0.6487$. The $t$-tests indicate that the measure of leg length ($L$) does not contribute significantly to the accuracy of prediction. Omitting this variable, $R = 0.6469$. The resulting prediction equation is given in Table 2.

Deviations from a reference weight, predicted on the basis of bony dimensions, indicate more accurately the under- or overdevelopment of soft tissues in a given individual than stature alone. Measurements of the thickness of subcutaneous fat, from skinfolds (*5*), help us to interpret these deviations in terms of approximate body composition (*6*). Leanness-fatness is thus added to underweight-overweight as a second "dimension" in the description of human body. Women, in comparison with men, would be classified as "light but fat," while football players or steelworkers (*7*) would be typically "heavy but lean."

Table 1. Prediction of weight ($W$, in kilograms) from five bony dimensions (in centimeters) and age ($E$, in years), with $t$-tests of the significance of the beta coefficients of the predictors in a multiple regression equation. Significance levels: $t_{0.05} = 1.960$, $t_{0.01} = 2.576$, $t_{0.001} = 3.291$.

| Predicted weight | | $t$-values of beta coefficients |
|---|---|---|
| $\hat{W} = -111.704$ | | |
| $+0.532$ | $S$ | 2.704* |
| $-0.220$ | $L$ | 0.966 |
| $+1.088$ | $C$ | 2.530† |
| $+1.114$ | $A$ | 3.801‡ |
| $+5.772$ | $H$ | 4.248‡ |
| $+0.134$ | $E$ | 2.150 |

* Significant at the 1-percent level. † Significant at the 5-percent level. ‡ Significant at the 0.1-percent level.

Table 2. Prediction of weight ($W$, in kilograms) from four bony dimensions (in centimeters) and age ($E$, in years), with $t$-tests of beta coefficients of the predictors.

| Predicted weight | | $t$-values of beta coefficients |
|---|---|---|
| $\hat{W} = -106.074$ | | |
| $+0.377$ | $S$ | 3.302* |
| $+1.051$ | $C$ | 2.455† |
| $+1.085$ | $A$ | 3.722* |
| $+5.794$ | $H$ | 4.265* |
| $+0.131$ | $E$ | 2.100† |

* Significant at the 0.1-percent level. † Significant at the 5-percent level.

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### References and Notes

1. L. B. Pett, *Am. J. Public Health* **45**, 862 (1955).
2. H. Marks, *Human Biol.* **28**, 217 (1956).
3. Mildred Trotter, *Am. J. Phys. Anthropol.* **12**, 537 (1954).
4. *Statist. Bull. Metrop. Life Insce Co.* **23**, 6 (1942); **24**, 6 (1943).
5. J. Brožek, *Human Biol.* **28**, 124 (1956).
6. Committee on Nutritional Anthropometry, Food and Nutrition Board, National Research Council, "Recommendations concerning body measurements for the characterization of nutritional status," *ibid.* **28**, 111 (1956).
7. A. Keys, *Diabetes* **4**, 447 (1956).

28 May 1956

# Letters

## Geophysical Research Shaft

A far-reaching modern social development is the massive financial backing which can, with increasing ease, be obtained for organized group attacks on new areas of basic knowledge. One thinks immediately of the large accelerators of the AEC, of the upper-air exploration programs, of the IGY, and of the artificial satellite. In general, none of these programs has immediate economic or national defense purposes; rather, their support by various governmental and private agencies reflects a general understanding of the ultimate utility of all physical knowledge. Although massive public support of science undoubtedly entails some undesirable consequences, the very technologic resources thus made available for scientific purposes mean the opening up of research areas otherwise inaccessible. Scientists in all fields should be aware of this opportunity.

The purpose of this note is to suggest one such possibility: a geophysical penetration of the earth's crust. I am not a geophysicist, nor am I qualified expertly to discuss the novel engineering problems involved. Nevertheless, a comparison of such an exploration with, say, the artificial satellite project (with regard to basic scientific worth, to possible practical uses, and to the expense of developing the technology involved) would seem immediately to confirm the suggestion that crustal penetration should be thought about, discussed, and evaluated by the scientific community. If the consensus is then that such a project would be valuable and feasible, we might expect on the afore-mentioned general grounds to find support forthcoming.

There appear to be many geophysical problems that could be profitably investigated by a physical penetration of the earth's crust and by an examination of the composition, properties, and physical condition of the mantle below the Mohorovičić Discontinuity. Among these are the following. (i) Knowledge of the variation of the earth's magnetic field below the surface could show whether its origin is in the crust or, alternatively, is the result of magnetohydrodynamic mechanisms in the core. (ii) Knowledge of the temperature variation below the surface is important for discussions of the earth's heat balance, radioactivity, and evolution. (iii) Knowledge of pressure, temperature, and density conditions at the outer boundary of the mantle are required for the numerical integrations in geophysical theories of Earth, Venus, and Mars. (iv) Geophysical theories of continent building require knowledge of the ultrabasic mantle material and of its relation to the basalt layer and to the granitic continental basement. (v) Penetration of the crust could shed light on the validity of the isostasy concept; this in turn has important and practical geodetic consequences. (vi) The earth's crust apparently has an unusually high radioactive content; it is important to determine whether this is actually so, and whether the radioactive elements have been fractionated out of the mantle. (vii) Knowledge of the composition of the mantle and, hence, of by far the largest part of the earth's mass is of great interest for astrophysical discussions of cosmic abundances. Furthermore, as in any scientific exploration, one cannot estimate in advance the importance of the new and unexpected phenomena and conditions that would be encountered; for example, it was suggested to me, not necessarily in jest, that the mantle might prove diamondiferous.

The site of the research shaft would be chosen so that the depth of the Mohorovičić Discontinuity was there a minimum. While this indicates drilling from an oceanic island, the logistic convenience of a continental location would also be a factor. Presumably seismic and volcanic complications should be voided. Sedimentary overlay per se is uninteresting, and ground water and other seepages could be avoided by seeking exposed Archean rock. I cannot adequately judge the relative importance of these factors.

It is, however, clear that present well-drilling technology would be inadequate to achieve the vertical depth required—perhaps 10 miles. One might, instead, imagine a small-bore (perhaps 12 inches in diameter, 30° down-slant) shaft, drilled into the granitic and basaltic rock by remote-controlled equipment. The power transmission from surface to drill could be by electric cable; rock removal, by belt or hydraulic means. The temperatures encountered should not be excessive (perhaps a few hundred degrees centigrade); the extreme pressures would probably require the use of heavy drilling muds for hydrostatic compensation.

Although estimation of costs for such a project is extremely difficult until preliminary site surveys and a technologic feasibility study have been made, I might point out that the large-scale rock tunneling on the surface costs perhaps $1 million per mile. We might expect that the proposed small bore, the use of modern remote-controlled instrumentation, and especially the absence of complicating seepage and ventilation problems would greatly reduce the cost from that of conventional tunneling. So this cost might well be commensurate with that of many modern group attacks on other basic areas of science, as is indicated in the first paragraph. I should like to thank James Garvey for many discussions, and for encouragement in this matter.

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## Teachers, Second Class?

In the letter by J. W. Still [*Science* **124**, 408 (31 Aug. 1956)] there is an implication that is frequently made by members of university staffs. The concept here implied is that one cannot be an effective teacher unless one worships the deity of research. This is too rarely challenged by those who teach in colleges and secondary schools where research is limited or does not exist. Perhaps the idea has developed because the top positions in the universities are open only to research personnel.

Why is research (of the classical type) essential for effective teaching? Does an expert on mice give a better course in general zoology or even in mammalogy? Does a protozoologist have greater insight into the evolutionary picture? I doubt it. In fact, this may often be a detriment by distorting the balance of the presentation.

There are individuals in any university who are strictly research persons, not because there is no need for them as teachers, but because they cannot teach. We do not call them second-class researchers for this reason. But one who teaches and does not do research is considered second rate.

Actually, a good college teacher keeps up with a far greater variety of scientific literature than the professional research

worker can afford to follow. His picture of science is usually broader and better balanced—even his training has usually been along broader lines. That there are those who can do both teaching and research well is a marvelous and rather rare thing. But please credit the teacher for his art and stop insisting that he is only second rate because his only research lies in the challenge of a vast literature.

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## Science and the Department of State

J. J. Nassau has illustrated well, with the specific case-history of Daniel Chalonge [*Science* **124**, 127 (20 July 1956)] the workings of the State Department's "exclusion principle." Were it not, in the long run, harmful to the general interests of science and to the good repute of our country, this policy would be ludicrous. The situation is further worsened by the invention of a "seclusion principle," which I should like to illustrate also in a specific case, my own.

Recent work in my laboratory has, we believe, important implications for the nature of bioelectrogenesis and of synaptic transmission. A paper before the 20th international Physiological Congress at Brussels was to deal with some of these. I had also made plans to meet with French and British colleagues to discuss these matters but was forced to default on all these commitments because the State Department refused me a passport.

I have also had to turn down invitations for visits to several Latin-American universities and that in Jerusalem which were planned to help enlarge the scope of their neurophysiological research. Once before, in 1952, I was prevented from visiting Israel, chiefly in my capacity as the chairman of the Medical Advisory Board to the Hebrew University and Hadassah. That visit was intended to expedite planning of the magnificent new medical center which is now beginning to rise near Jerusalem.

I happen to hold political views somewhat at variance with those which John Foster Dulles trumpets with confidence and moral unction. This is my privilege as an exercise of conscience. I am also a member of two organizations that the Attorney General in his alleged authority has placed on an *index expurgatorius*. The National Council of American-Soviet Friendship, organized during Hitler's threat to civilization, received considerable encouragement from President Roosevelt's administrations. In the face of the present, even greater threat from the hydrogen bomb, President Eisenhower and some of his colleagues are aware of the need again for American-Soviet friendship—but not, it seems, the Attorney General or the Secretary of State. The Committee for the Protection of the Foreign Born is also proscribed. Whatever the curious reasoning for this, A. J. Carlson has testified eloquently and cogently against its "subversive" label. Foreign-born also, I share Carlson's views and do not concede the Attorney General's legal or intellectual right to make proscriptive lists. Therefore, although I do not have the time to be active in these two bodies, I do not propose to resign in order to grovel for a passport.

Multiplied even a few times, the operation of the State Department's two "principles" affects unpleasantly foreign opinion of our country. Within, the effects may be more disastrous. Our country is fortunate in its wealth and high general level of education. The present high state of our science reflects these factors, but can we afford even a "little" Chinese Wall, which hinders scientific communication? Another effect is the tendency to breed conformity and intolerance, modes of thinking that become deadly when carried over into science. Many thoughtful people suspect that such a spilling over has already begun. Certainly, there is not today a concerted expression of outrage at a beaurocracy which, although irrational and silly, is also actually or potentially harmful to science. Do not our scientific societies, dedicated to the promotion of science, have an obligation to react vigorously; to alert public opinion against the stupidities and their dangers? Can they afford to be silent and still remain true to their trust?

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## Smugness and "Success"

It seems a pity that the delightfully uninhibited Agnes Brues [*Science* **124**, 409 (31 Aug. 1956)] begrudges us scientists the right to be oracular, useful, and smug in the one easy, simple way we might help to counteract the pitfalls of the present technologic society. She does not, I suppose, approve of any legislation to "protect" the ignorant or the lone widow, and she has revealed to me how dodderingly paternalistic my social concepts have remained, in this clean, competitive world.

John Tyndall, one of my scientific heroes, was a trifle smug; so is the—apparently competent—surgeon who cut me up. Something of classics in the matter of smugness are literary and art critics, Hollywood stars, and the staff of a prominent news magazine. A really top-flight performer in this line is a popular politician from the lady's part of the country, who carries on despite a recent alleged come-uppance.

The lady undoubtedly agrees that all these are examples of smugness and bossiness. A freedom to indulge these vices, more or less disguised, seems to be an incentive to "success." Is the purer form of egghead a poor disguiser, or just too small an operator? Or does he needle us to face, today, unpleasantnesses we should rather maybe glance at, tomorrow?

Despite seeming dissent, let me say: if all citizens were as hard to sell as Agnes Brues, most occasion for social correctives would vanish.

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## Second BS Degree for Teachers

In relation to the master's degree for teachers [*Science* **124**, 322 (17 Aug. 1956)] I wish to make three suggestions to the AAAS Council for action during this year.

I propose that (i) the Council go on record as opposing any actions which tend to reduce the traditional high standards of the MS degree, (ii) the Council consider recommending to the nation that a second bachelor's degree be recognized as a more suitable training for school teachers than a diluted MS degree, (iii) if for any reason the preceding recommendation could not be made (slight modifications of existing rules concerning second BS degrees should remove the sound reasons against them), the Council should recommend to the nation that if the MS degree for teachers is allowed, it should be so designated —MST.

In reply to John Mayor's statements about the problem of teachers in classes with freshmen and sophomores, my experience of two decades says that there is no problem, once they are actually in the classroom. Teachers in the college classes are almost always good students, and it is a pleasure for the college teacher to have them in class.

I join with Jerry Kollros in urging that the AAAS do some "promoting among school boards and any other controlling agencies." Other avenues for influencing education are likely to be plugged by men of good will acting on concepts of extremely limited applicability which they mistake for general truths.

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# Book Reviews

**Chromosome Botany.** C. D. Darlington. Allen & Unwin, London, 1956 (order from Macmillan, New York). 186 pp. Illus. $2.75.

C. D. Darlington's book is devoted largely to the role of the chromosomes in the evolution, differentiation, and distribution of plant species in nature and in cultivation. He shows how cytogenetic analysis has clarified the origin and relationships of many species of flowering plants.

In considering the factors responsible for variation and speciation, Darlington discusses hybridization, polyploidy, structural chromosome changes, aneuploidy, and apomixis. The effect of polyploidy on the geographic distribution of species is shown to be related to adaptation to new territory and not necessarily correlated with latitude or elevation. The migration of species is correlated with chromosome change, although "an ecological diversity at the centre of a species demands a morphological and a genetic diversity, but it does not so imperatively demand a chromosome diversity."

The consideration of the origin and evolution of the cultivated economic plants in less than 30 pages necessarily limits the material presented, but it is surprising that Kihara's outstanding work on the cytogenetics of wheat is not mentioned. The chapter on the chromosome relationships in the ornamental plants is a little more adequate, although it is largely confined to work done in England.

According to Darlington, systematic botany "continues to rest half-poised on the eighteenth-century fiction that the living world is inhabited by fixed species which exist, on the one hand, as 'types' represented by original specimens in museums and, on the other hand, as 'varieties' diverging from these types by some ineffable process of mutation." Such criticism is no longer justified, since most taxonomists now use the tools of cytology, genetics, ecology, and internal anatomy in their investigations. But many of the older taxonomists, using only herbarium specimens, often showed great ability, or intuition, in separating species into groups which have withstood subsequent cytogenetic tests. And, as Darlington points out, John Ray in 1686 defined a species in terms that are still valid.

*Chromosome Botany* is too limited in its scope to be used as a textbook, but it should be of interest to all botanists, agronomists, and horticulturists who are interested in the evolution, relationships, and improvement of plant species and varieties.

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**Report of the Special Committee on the Federal Loyalty-Security Program of the Association of the Bar of the City of New York.** Dodd, Mead, New York, 1956. xxvi + 301 pp. $5.

To an area of public policy befogged by irresponsible charges, questionable statistics, and widespread misunderstanding, this report by a committee of distinguished practicing lawyers brings a new light of temperance and reason. The study was sponsored as a public service by the Association of the Bar of the City of New York and was financed by a grant from the Fund for the Republic, Inc. Dudley Baldwin Bonsal headed the committee, which was aided in its work by a small legal staff under Elliott E. Cheatham of Columbia University Law School. Some 150 informed persons, in and out of government, provided information from their experience on the operation of the federal loyalty-security program. The result is a carefully weighed review of the manner in which it has operated and a series of specific recommendations for making it more effective where it is most needed and less of a menace to justice and freedom where it has been overextended.

Early chapters discuss the basic problem of reconciling liberty with security, the nature of the Communist threat, and the countermeasures by the United States to meet the threat. The threat is seen as clear and unmistakable; the need for countermeasures, indisputable. But the committee notes that "if fear of totalitarianism were to force us into coerced uniformity of thought and belief, we should lose security in seeking it" (p. 27). Thus the need is for a security program that can continue indefinitely without interfering with scientific or economic development and without undermining the average citizen's sense of freedom and fair treatment by his government. Underlying the entire report is this thesis that myopic preoccupation with secrecy and security measures must not jeopardize this more vital and fundamental basis of true national security.

Personnel security programs are, of course, one phase of internal security. There are now several of these, covering some 6 million workers in and out of government. The committee would reduce this coverage to about 1.5 million by limiting the program to truly sensitive positions and abandoning outright the Port Security (seamen and longshoremen) and International Organizations Programs. Remaining with little change would be the Department of Defense Industrial Security Program, covering about 3 million workers in private industry, and the Atomic Energy Commission program, applicable to some 80,000 of its own and private contractors' employees. The program covering some 2.3 million civilian employees of the Federal Government under Executive Order 10450 would come in for a substantial overhaul, for it is here that the weaknesses in the current programs are believed to be most marked. These weaknesses are summarized as (i) lack of coordination and supervision among the programs, (ii) excessively broad coverage, (iii) too great rigidity in standards and criteria in view of the variety of elements to be considered, and (iv) the failure of security procedures at present to protect adequately the interests of either the government or its employees.

The committee's recommendations to overcome these weaknesses are clear and to the point, although they are too extensive for detailed recital here. A Director of Personnel and Information Security would be established in the Executive Office of the President, both to assure uniformity and fairness in the various programs and to help control the classification of information, since access to the latter tends to determine which jobs are "sensitive." The committee anticipated somewhat the Supreme Court decision of 11 June 1956, in *Cole v. Young et al.* (351 US 442) when it recommended that security clearances apply only to sensitive positions and to no others. The now infamous policy of "guilt by association" implied in uncritical use of the Attorney General's list of subversive organizations would be abandoned in favor of a policy permitting balanced judgment of suitability for employment in the light of all the evidence available. The committee recommends that the list itself either be abolished or

thoroughly revised to keep it current, to make clear the period and nature of the subversive activity involved, and to include only organizations given notice and hearing in accordance with due process of law.

The balance of the recommendations are largely procedural but nonetheless important. They are aimed clearly at preserving the elements of traditional justice in a field in which the committee found too many abuses for comfort. Among them is a central board to screen charges against Civil Service employees, making charges known to such employees in the fullest possible detail, continuing pay while the case is pending, limiting representation of the agency filing charges to one man on a three-man hearing board, having one lawyer on each board, guaranteeing the employee representation by counsel (at government expense if he is cleared), granting subpoena powers to screening and hearing boards, and curtailing "double-jeopardy" on substantially the same facts.

Some of the recommendations may appear to be unduly oriented toward the precepts of legal procedure, but I, who am no lawyer, think not. Only a strong reaffirmation of the basic procedural rights of citizens accused of a wrong, when job and reputation are at stake, will suffice to restore confidence in the security clearance program among innumerable scientists and other observers who have come to regard it with distaste. The discriminating and integrated program which the special committee here advances could, if put into effect, go far toward restoring that confidence.

The appendixes contain the best available statistics on the operation of the loyalty-security program to date as well as a useful compilation of the relevant statutes, orders, and regulations. There is an index.

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**Medicinal Chemistry.** vol. II. F. F. Blicke and C. M. Suter, eds. John Wiley, New York; Chapman & Hall, London, 1956. 311 pp. $10.

The objective of the Medicinal Chemistry series is to summarize available data on structure-activity relationships of various types of drugs, with brief discussions of methods of synthesis and pharmacological test procedures.

The second volume consists of four reviews, each written by recognized experts. The first section by A. Stoll, on the cardiac glycosides, has little biological data and consists almost entirely of chemical methods used in proving structure. It includes a supplement by T. L. Johnson. John A. Hogg and Jerome Korman, in the second section, thoroughly review the synthetic estrogens. The third by C. M. Suter briefly describes arylpiperidine analgesics. The last one, by G. E. Ullyot and J. F. Kerwin, gives a comprehensive treatment of the haloethylamine adrenergic blocking agents.

This volume, as well as others in the series, has undoubted value as a reference book. A large part of it is arranged as tabular data, and the authors are to be congratulated for their painstaking efforts in presenting so much information in so little space.

From the bibliography at the end of each review it must be assumed that the articles were written a number of years back. The lapse of time before publication is to be regretted, since the reader should expect to have the very latest in the rapidly expanding field of medicinal chemistry. This is particularly unfortunate in regard to the unusually well-written and readable chapter on adrenergic blocking agents. Most of the glowing potentialities of the β-halo-ethylamines in clinical practice have evaporated in the heat of clinical trial. Furthermore, it is now generally accepted that norepinephrine, rather than epinephrine, is the neurohumoral agent against which these substances should be effective.

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## Miscellaneous Publications

*(Inquiries concerning these publications should be addressed, not to* Science, *but to the publisher or agency sponsoring the publication.)*

*A Revision of the Genus Megarthroglossus Jordan and Rothschild, 1915 (Siphonaptera: Hystrichopsyllidae).* University of California Publ. in Entomology, vol. 11, No. 3. Eustrogio Mendez. University of California Press, Berkeley, 1956. 34 pp. $0.85.

*Joint Spacing in Concrete Pavements: 10-Year Report on Six Experimental Projects.* Highway Research Bd. Research Rept. 17-B. National Academy of Sciences–National Research Council, Washington, 1956. 159 pp. $2.70.

*The Child and His Family in Disaster: A Study of the 1953 Vicksburg Tornado.* Disaster Study No. 5. Stewart E. Perry, Earle Silber, Donald A. Bloch. 62 pp. $1.50. *Social Aspects of Wartime Evacuation of American Cities.* With particular emphasis on long-term housing and reemployment. Disaster Study No. 4. Fred C. Ikle and Harry V. Kincaid. 100 pp. $2. Committee on Disaster Studies, National Academy of Sciences–National Research Council, Washington, 1956.

*National Vitamin Foundation, Report to the Board of Governors by the Scientific Director.* 1 Jan. 1955–31 Dec. 1955. The Foundation, New York 22, 1956. 73 pp.

*Geographic Distribution in Exchange Programs.* Geographic considerations in the selection and placement of U.S. Government-sponsored exchange students. Committee on Educational Interchange Policy, New York, 1956. 17 pp.

*Annotated Bibliography of Hydrology (1951–54) and Sedimentation (1950–54) United States and Canada.* Supplement to the *Annotated Bibliography on Hydrology* and the *Annotated Bibliography on Sedimentation.* Compiled and edited by American Geophysical Union, Washington, 1956 (order from Supt. of Documents, GPO, Washington 25). 207 pp. $1.25.

*Educators Guide to Free Slidefilms.* Compiled and edited by Mary Foley Horkheimer and John W. Diffor. ed. 8. 188 pp. $5. *Elementary Teachers Guide to Free Curriculum Materials.* Patricia Horkheimer Suttles. ed. 13. 318 pp. $5.50. Educators Progress Service, Randolph, Wis., 1956.

*New York Foundation, Two Year Report.* 1954–1955. New York Foundation, New York, 1956. 43 pp.

*Your Career as an Engineer in Aviation.* Institute of the Aeronautical Sciences, New York 21, 1956. 21 pp.

*New Channels for the Golden Years.* New York State Joint Legislative Committee on Problems of the Aging (Available from Thomas C. Desmond, Chairman, 94 Broadway, Newburgh, N.Y.). 151 pp.

*Tobacco Industry Research Committee, Report of the Scientific Director, 1956.* The Committee, New York, 1956. 24 pp.

*Report of the Pest Infestation Research Board, 1955.* With the report of the Director of Pest Infestation Research. 62 pp. 4s. *Report of the Hydraulics Research Board, 1955.* With the report of the Director of Hydraulics Research. 56 pp. 4s. *Report of the Chemistry Research Board, 1955.* With the report of the Director of the Chemical Research Laboratory. 88 pp. 4s. *Report of the Water Pollution Research Board 1955.* With the report of the Director of Water Pollution Research. 81 pp. 4s. *Wage Accounting by Electronic Computer.* Report No. 1 of the Inter-Departmental Study Group on the Application of Computer Techniques to Clerical Work. 57 pp. 2s. 6d. *Automation.* A report on the technical trends and their impact on management and labor. 106 pp. 6s. Department of Scientific and Industrial Research, Her Majesty's Stationery Office, London, 1956.

*Report of the Medical Research Council for the Year 1954–1955.* Committee of Privy Council for Medical Research. Her Majesty's Stationery Office, London, 1956. 286 pp. 10s.

*The Application of Physical Sciences to Food Research, Processing and Preservation.* Southwest Research Institute, San Antonio, Tex., 1956. 179 pp. $5.

*A Study of African Chironomidae.* pt. II. Bull. Brit. Mus. (Nat. Hist.) Entomology, vol. 4, No. 7. Paul Freeman. British Museum (Natural History), London, 1956. 80 pp. £1.

*Midwest Research Institute, Annual Report of the President to the Trustees.* 11th annual report. Midwest Research Institute, Kansas City 10, Kansas, 1956. 17 pp.

# Meetings and Societies

## Religion in the Age of Science

The third summer Conference on Religion in the Age of Science took place on Star Island, Isles of Shoals, about 10 miles off Portsmouth, N.H., during the week 28 July–4 Aug. About three dozen persons whose professional work is in science, three dozen in religion, and four or five dozen laymen including educators, lawyers, and philosophers, many of them accompanied by other members of the family, spent a week on this 92-acre heap of rock talking about religion in the light of science. Participants came from about 20 states and two foreign countries. Discussions for some of the conference members were fairly continuous from 9 in the morning until near midnight, although there were only two or three formal papers per day. A scholarship fund provided by the Rockefeller Foundation made possible attendance by 25 students of theology, science, and other fields at the graduate level.

The significance of this conference lies perhaps not so much in the particular formulations or reformulations of religious doctrine presented as in the fact that there has been established a rather unique concurrence on the part of professional people from a wide range of the spectra of both science and theology on a fruitful program for integrating religion and science. Reports on the previous two conferences [*Science* **120**, 522 (1954) and **122**, 1277 (1955)] have indicated the kind of people involved. New speakers in 1956 included Marion J. Bradshaw, professor of the philosophy of religion at Bangor Theological Seminary; Erwin R. Goodenough, professor of the history of religion at Yale; Robert Ulich, professor of education at Harvard; Philip Rieff, assistant professor of sociology at Brandeis; Robert Bellah, senior fellow of the Institute of Islamic Studies at McGill; and Oscar Riddle, for many years associated with the department of experimental evolution of the Carnegie Institution of Washington at Cold Spring Harbor, N.Y.

This concurrence on a basic approach to the problem of religion in an age of science can perhaps be stated as follows. Knowledge of good and evil or of values or of man's ultimate concerns—that is, the area of religious doctrine—is considered to be essentially one with, and inseparable from, all other knowledge and to be capable of extension and correction in the same ways. This does not mean that our acquisition of knowledge about ethics or the nature and destiny of man is limited to knowledge gained by recent scientific methods; but it does not exclude them. Science, in short, is a part of the process by means of which valid information about man's highest concerns is revealed to him. Because of the very rapid current advance of scientific knowledge and the patently growing incompatibilities of various religious doctrines, the conference members, for the most part, seem to feel the need for a restatement of religion.

At the same time, there seems to be among the members of the conference the scientist's respect for the facts of religion and religious institutions. These are looked upon as evolved structures or patterns of human culture having the same kind of validity and usefulness in supporting life as do other evolutionary structures. And there is also a scientist's hope that one can find beneath the seemingly paradoxical and irrational phenomena of religion some kind of rational conceptual scheme to account for them.

The dominant concern of the conference is admittedly not science but man, according to Harvard astronomer Harlow Shapley, chairman of the advisory board of the Institute on Religion in an Age of Science, which sponsors the conference. But science, according to Edwin P. Booth, professor of historical theology at Boston University and president of the institute, is clearly the source of new truth in terms of which religious doctrines must be revised.

Perhaps the most interesting and exciting point of the conference week was the Thursday evening session of Shapley's "Hollow Square" colloquium, when the conference members sit informally from about 10 to 12 in the evening. Booth was quizzed on his religious position. He was one of the original group of clergymen who invited the cooperation of scientists in a thoroughgoing reconsideration of Christian theology and is able himself to interpret religious experience in terms of the realities of history, and biography, and within, rather than without, the frame of science, in a way that makes this conference the unique phenomenon that it is—a place where "hard-boiled" men of science and religious professionals of various kinds experience together an excitement that is at once religious and enlightened by scientific perspectives. If the reader can imagine a creative and mutually respectful interchange between a theologian and, for instance, the religion-whipping author of *The Unleashing of Evolutionary Thought*, Oscar Riddle [see the reviews in *Science* **123**, 144 (1956), and more particularly *Sci. Monthly* **82**, 317 (1956)], he can imagine the quality of this conference. In a time when many of Christendom's theologians have given up the battle with science and are turning, presumably for security and strength, to a position in which they claim the isolation and exemption of religious knowledge from any contact with scientific knowledge, this is a significant event. It is also a positive and new approach, since even in the heyday of religious liberalism during the earlier part of the present century, there seems to have been no comparable coming together of scientists at the invitation of religious professionals to reconsider religious doctrine for a new age. Theologian Booth pressed hard for a consideration of the oneness of truth or knowledge, whether the subject matter was physics or human values, and he expressed the conviction that "natural" and "revealed" knowledge could be reduced to a single system. Perhaps the religion of the future will be in the words of philosopher Robert Ulich a covenant between man and his ever-expanding universe.

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## Council on Library Resources, Inc.

The formation of the Council on Library Resources, Inc., an organization whose purpose is to assist in solving the problems of libraries generally, and of research libraries in particular, was announced on 18 Sept. following its initial meeting in New York at which it elected officers and voted to accept a $5-million grant of funds from the Ford Foundation to support its initial activities over a 5-year period. The council will assist in the solution of library problems by providing grants for the support of research and the demonstration of new techniques and methods. It will also undertake to coordinate efforts to improve the resources and services of libraries, and to improve relations between American and foreign libraries and archives.

Elected as president and executive


**Our sweet laborers** have finished the task of preparing the address labels. By now "Eastman Organic Chemicals, List No. 40" should have reached all who have in years past indicated a desire to keep receiving each new edition of the catalog of the 3500-odd reagents and other organic compounds quickly available in laboratory quantities from a single source of known integrity. Others who want the new catalog should address ***Distillation Products Industries,*** Eastman Organic Chemicals Department, Rochester 3, N. Y. (Division of Eastman Kodak Company).

head of the council is Verner W. Clapp, who has resigned as chief assistant librarian of the Library of Congress to accept the post. The scientists included on the board of directors of the council are Joseph C. Morris, vice president of Tulane University, head of its department of physics, and a director of the National Science Foundation; and Warren Weaver, vice president of the Rockefeller Foundation and former president of the AAAS. The council, a wholly independent nonprofit educational research organization, has been incorporated under the laws of the District of Columbia, and has its national offices in Washington, at 1025 Connecticut Ave., NW.

## Meeting Notes

■ A conference on the use of drugs in treating mental patients was held in Washington, D.C., 21–22 Sept. Representatives of public and private psychiatric hospitals, the pharmaceutical industry, university departments of psychiatry, and research institutes, in addition to Government officials and interested scientists, discussed research problems encountered in evaluating the effectiveness of drugs.

Committees of psychiatrists, pharmacologists, neurophysiologists, psychologists, sociologists, and biometricians met for 2 days beforehand to lay the groundwork for the talks. Sponsors of the conference were the National Institute of Mental Health, American Psychiatric Association, and the Division of Medical Sciences of the National Academy of Sciences–National Research Council.

■ More than 20 original clinical papers on the uses of Meprobamate and other tranquilizing agents used in mental and emotional problems will be presented during a 2-day conference to be held under the auspices of the New York Academy of Sciences at the Barbizon Plaza Hotel, New York, 18–19, Oct. This conference will explore their uses in new areas of mental health as well as review the work that has been done during the past 2 years by clinicians and psychiatrists in testing hospitalized and ambulatory mental patients.

Reports on the use of Meprobamate for Air Force personnel, and its effect on the reflexes, responses, and awareness of "normal" subjects will be presented. Other subjects will include the effect of Meprobamate on conditioned reflexes and conditioned fear and behavior, and its use in treating disturbed children, senile psychoses, muscle spasm, headache, alcoholism, anxiety states, cerebral palsy, and other indications. James G. Miller, Mental Health Research Institute, University of Michigan, and Frank M. Berger, medical director of the Wallace Laboratories, New Brunswick, N.J., are cochairmen of the conference.

## Forthcoming Events

### November

*10.* Society for the Scientific Study of Religion, fall meeting, Cambridge, Mass. (R. W. Burhoe, American Acad. of Arts and Sciences, Cambridge 36.)

*11–12.* American Soc. for the Study of Arteriosclerosis, annual, Chicago, Ill. (R. G. Gould, P.O. Box 1663, Los Alamos, N.M.)

*11–17.* Cardiology, 5th Inter-American cong. of, Havana, Cuba. (I. Chavez, Calzada de la Piedad 300, Mexico, D.F., Mexico.)

*12–14.* Association of Military Surgeons of the U.S., annual, Washington, D.C. (S. E. Womeldorph, AMSUS, Suite 718, 1726 Eye St., NW, Washington 6.)

*12–15.* American Petroleum Inst., 36th annual, Chicago, Ill. (API, 50 W. 50 St., New York 20.)

*12–16.* American Public Health Assoc., 84th annual, Atlantic City, N.J. (R. M. Atwater, 1790 Broadway, New York 19.)

*12–16.* American Soc. of Agronomy, annual, Cincinnati, Ohio. (L. G. Monthey, 2702 Monroe St., Madison 5, Wis.)

*13–15.* Historical Development of Physi-

ological Thought, symposium, Brooklyn, N.Y. (E. Goodwin, State Univ. of New York, College of Medicine, Brooklyn 3.)

*14–15.* Industrial Hygiene Foundation, 21st annual, Pittsburgh, Pa. (C. R. Walmer, IHF, Mellon Inst., Pittsburgh.)

*14–16.* Optics and Microwaves, symp., Washington, D.C. (Symp. on Optics and Microwaves, P.O. Box 355, Falls Church, Va.)

*14–16.* Newer Developments in the Diagnosis and Management of Cancer, symp., Duarte, Calif. (J. Love, Director, Div. of Postgraduate Medical Education, City of Hope Medical Center, Duarte.)

*15.* Enzymes and Feed, Assoc. of Vitamin Chemists, Chicago, Ill. (M. Freed, Dawe's Laboratories, Inc., 4800 S. Richmond St., Chicago 32.)

*15–16.* American Philosophical Soc., Philadelphia, Pa. (APA, 104 S. 5 St., Philadelphia 6.)

*15–16.* Operations Research Soc. of America, 10th natl., San Francisco, Calif. (T. E. Oberbeck, U.S. Naval Post Graduate School, Monterey, Calif.)

*15–16.* Society of Technical Writers, jointly with Assoc. of Technical Writers and Editors, New York, N.Y. (S. F. Shapiro, STW, P.O. Box 22, Newton Centre 59, Mass.)

*15–17.* Acoustical Soc. of America, Los Angeles, Calif. (W. Waterfall, ASA, 57 E. 55 St., New York 22.)

*18–25.* National Meeting of Surgeons, Mexico City, Mexico. (Intern. Acad. of Proctology, 147–41 Sanford Ave., Flushing, N.Y.)

*19–20.* Entomological Soc. of America, Eastern Branch, Atlantic City, N.J. (B. F. Driggers, Experiment Station, New Brunswick, N.J. )

*21.* Arctic Branch, Alaska Div., AAAS, College, Alaska. (Miss C. Juedes, Box 47, College.)

*22–23.* Calder Hall Nuclear Power Station, conf., London, England. (Secretary, British Nuclear Energy Conference, 1–7 Great George St., London, S.W.1.)

*22–3.* International Cong. of Industrial Chemistry, 29th, Paris, France. (J. Gerard, Société de Chimie Industrielle, 28, rue Saint-Dominique, Paris VII$^{e}$.)

*23–24.* American Mathematical Soc., Evanston, Ill. (E. G. Begle, 207 Leet Oliver Memorial Hall, Yale Univ., New Haven 11, Conn.)

*23–24.* American Physical Soc., Chicago, Ill. (K. K. Darrow, APS, Columbia Univ., N.Y. 27. )

*23–24.* American Soc. of Animal Production, annual, Chicago, Ill. (W. M. Beeson, Dept. of Animal Husbandry, Purdue Univ., W. Lafayette, Ind.)

*24.* American Ethnological Soc., New York, N.Y. (A. G. James, Hunter College, Bronx 68, N.Y.)

*25–30.* American Rocket Soc., annual, New York, N.Y. (J. J. Harford, ARS, 29 W. 39 St., New York 18.)

*25–30.* American Soc. of Mechanical Engineers, annual, New York, N.Y. (C. E. Davies, ASME, 29 W. 39 St., New York 18.)

*26–28.* American Soc. of Refrigerating Engineers, Boston, Mass. (R. C. Cross, ASRE, 234 Fifth Ave., New York 1.)

*26–30.* Automation Exposition, 3rd intern., New York, N.Y. (TIAE, Richard Rimbach Associates, Inc., 845-A Ridge Ave., Pittsburgh 12, Pa.)

*27–30.* American Medical Assoc., clinical, Seattle, Wash. (G. F. Lull, AMA, 535 N. Dearborn St., Chicago 10, Ill.)

*27–30.* National Chemical Exposition, 9th, Cleveland, Ohio. (American Chemical Soc., 1155 16 St., NW, Washington 6, D.C.)

*28–30.* American College of Cardiology, 5th interim, Pittsburgh, Pa. (P. Reichert, ACC, Empire State Bldg., New York, N.Y.)

*28–30.* International Conf. on Ozone, 1st, Chicago, Ill. (C. E. Thorp, Armour Research Foundation, 35 W. 33 St., Chicago 16.)

*29–30.* Veterinary Symposium on "Meti-Steroids," New York, N.Y. (J. C. Siegrist, Schering Corp., Bloomfield, N.J.)

*30.* American Rheumatism Assoc., Bethesda, Md. (E.F. Hartung, 580 Park Ave., New York, N.Y.)

*30–1.* Oklahoma Acad. of Science, Stillwater. (D. E. Howell, Entomology Dept., Oklahoma A. & M. College, Stillwater, Okla.)

*30–1.* Tennessee Acad. of Science, Murfreesboro. (D. Caplenor, Dept. of Biology, Peabody College, Nashville 4, Tenn.)

### December

2. American Acad. of Dental Medicine, 11th mid-annual, New York, N.Y. (A. Reiner, 114–01 201 St., St. Albans 12, N.Y.)

*2–7.* Radiological Soc. of North America, Inc., annual, Chicago, Ill. (D. S. Childs, 713 E. Genesee St., Syracuse 2, N.Y.)

*5–7.* Instrumentation Conf., 2nd, Inst. of Radio Engineers, Atlanta, Ga. (M. D. Prince, Engineering Experiment Station, Georgia Inst. of Technology, Atlanta.)

*(See issue of 21 September for comprehensive list)*

# PERSONNEL PLACEMENT

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**POSITIONS REQUIRING DEGREES IN MEDICINE OR SCIENCE:** (a) **Biochemist;** Ph.D. to head division, well-known eastern research institute; must be qualified to consult, collaborate with physicists, microbiologists on biochemical aspects of research; excellent research facilities, including isotopic research; top salary, excellent perquisites. (b) **Bacteriologist and Biochemist;** 150-bed general hospital, laboratory under supervision of highly qualified pathologist; $5400–$6000; Florida resort community. (c) **Bacteriologist;** newly opened 300-bed general hospital, affiliated important medical school; B.S. or M.S.; to $4200; city 250,000. (d) **Bacteriologist;** private allergy research laboratory; $4200; popular southeastern resort. (e) **Biochemist;** Ph.D. qualified physiology, animal experimentation; participate in studies on physiological function, biochemistry of platelets, leukocytes, erythrocytes; $6100 or $7200, Civil Service appointment; government research laboratory; Midwest. Woodward Medical Personnel Bureau, 185 North Wabash, Chicago. X

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**Radiology.** Opening for a responsible individual as assistant in radiology for work in isotope laboratory. Academic appointment; research opportunity; minimum salary $5500. Minimum requirements, B.S. in physics. Some experience desired. Submit replies to Dr. Walter S. Moos, Department of Radiology, University of Illinois, 840 S. Wood Street, Chicago 12, Illinois. 10/5, 12

**Research Assistant** in research laboratory investigating biochemical aspects of central nervous system function. Opportunity for qualified individuals to simultaneously pursue graduate studies. Salary to $4000. Location: New England. Box 233, SCIENCE. 10/19; 26

**Science Writer** for new 516-bed research hospital and basic science research institute. Basic policy clinical and basic science research into the problem of cancer and allied diseases. Salary open. Qualifications: bachelor's degree and 2 years of writing experience. Box 221, SCIENCE. ew 11/23

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## POSITIONS OPEN

**UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG, SOUTH AFRICA.** Applications are invited for appointment to a post of **Senior Lecturer** and a post of **Lecturer** on the staff of the University's Department of Physiology, Medical School. Candidates with a medical qualification or a higher degree in experimental physiology and/or biochemistry are eligible for appointment.

The salary scale attached to the post of Senior Lecturer is £1100 × £50 – £1450 and to the post of Lecturer £850 × £50 – £1150. In addition, a married man will receive a cost of living allowance at the rate of £234 per annum. The commencing salary will depend upon qualifications and experience in teaching and research.

Membership of the Provident Fund is compulsory and involves a contribution at the rate of 7 percent of the salary paid, the government and the university together contributing an equal amount. Membership of the Staff Medical Aid Fund is compulsory in the case of an officer who is found eligible for membership.

Applicants are advised to obtain a copy of the information sheet regarding the above vacancies from the Secretary, Association of Universities of the British Commonwealth, 36 Gordon Square, London, W.C.1. Applications close in South Africa and London on *31 October 1956.* X

## GRANTS

**NATIONAL RESEARCH COUNCIL OF CANADA POSTDOCTORATE FELLOWSHIPS 1957–1958.** Approximately 115 fellowships will be awarded for 1957–1958 by the National Research Council. Of these, 50 will be tenable in National Research Council Laboratories in Ottawa, Saskatoon, and Halifax; 25 in laboratories of the Canada Department of Agriculture, located at various centers; 22 in laboratories of the Canada Department of Mines and Technical Surveys in Ottaw and Victoria; and 20 in laboratories of Canadian universities.

Applicants should not be more than 35 years of age and should possess a Ph.D. degree from a recognized university, or expect to obtain such a degree before taking up an award. There are no restrictions regarding nationality of applicants, but successful candidates must meet all Canadian immigration requirements.

The annual stipend, which is free of income tax, is $3700 for single fellows and $4500 for male fellows who are married. An allowance toward the cost of travel is also paid.

The fields in which fellowships are available in the laboratories of the National Research Council, the Department of Agriculture, and the Department of Mines and Technical Surveys are described in greater detail in booklets that may be obtained on request, together with application forms. Applicants who are interested in fellowships in the universities may write directly to these institutions or to the National Research Council for information. The closing date of the competition is *15 February 1957.*

Inquiries should be addressed to Awards Officer, National Research Council, Ottawa 2, Canada. X

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**Program content**

1. The two-session general symposium, "Moving Frontiers of Science," arranged by the Committee on AAAS Meetings.
2. The six sessions of the Conference on Scientific and Technical Editorial Problems.
3. Details of the anniversary celebrations of the AAAS-Gordon Research Conferences, Botanical Society of America, Freud *et al.*
4. Programs of the 18 AAAS sections (symposia and contributed papers).
5. Programs of the more than 80 participating societies.
6. The Special Sessions: AAAS, Academy Conference, Conference on Scientific Manpower, National Geographic Society, Phi Beta Kappa, RESA, Sigma Xi.
7. Details of the Hotel Statler—center of the Meeting—and other hotels and session sites.
8. Titles of the latest foreign and domestic scientific films to be shown in the AAAS Science Theatre.
9. Exhibitors in the 1956 Annual Exposition of Science and Industry and descriptions of their exhibits.

**Directory content**

1. AAAS officers, staff, committees for 1956.
2. Complete roll of AAAS presidents and their fields.
3. The more than 265 affiliated organizations.
4. Historical sketch and organization of the Association; the 1955 revised Constitution and Bylaws.
5. Publications of the Association.
6. AAAS Awards and Grants—including all past winners.
7. Membership figures by sections.
8. Section committees (Council members) in detail.
9. Local committees.
10. Future Meetings of the AAAS through 1962.
11. New and current activities of the AAAS.

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